THE LABORATORY

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MAY 16 '61

19TH CENTURY GLASSBLOWERS—part of a 3500-year-old tradition of making beautiful glass by hand. Today, research "tailors" glass to be as soft as cotton, as hard as precious stones.

THE LABORATORY® for the latest developments in instrumentation and technique

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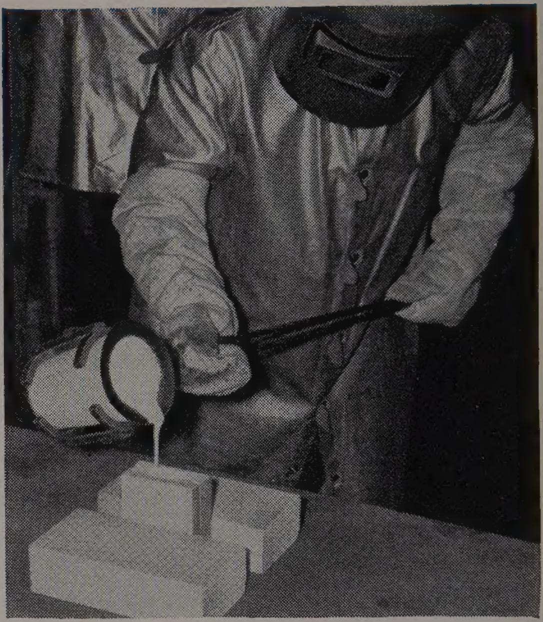
Glass is a state of mind



Restless search: Corning Glass Works development technician pours experimental "lab-size" melt of a brand-new glass. Corning has 75,000 formulas, melts 200 additional new formulas a week.

SOMETHING WONDERFUL, important, and slightly offbeat is liable to happen whenever researchers tackle glass.

There's something about the versatility, tremendous intrinsic strength (possibly 3,000,000 lbs per sq. in.), and mystery of this age-old material that brings out the best in laboratory ingenuity.

▶ From the laboratory of Japanese glass scientists Taro Hayashi and Shoji Shida comes glass for curtains and window-blinds that are light lavender colored in sunlight, grow transparent as the sun goes down. (Pittsburgh Plate Glass and Libby-Owens-Ford scientists see common use of variable-transmission glass by 1970.)

▶ Research into glass fiber optics at Armour Research Institute is transforming a trivial curiosity into an important medical tool. Bundles of these thin flexible glass fibers transmit light around corners, even over tortuous paths, returning the reflected light to the observer. Not only can every part of the stomach and duodenum beyond it be examined with minimum discomfort; there's now a possibility the interior of the heart can be examined too.

▶ Corning Glass Works researchers Robert Brill and Harrison Hood have given archeologists—scraping away at the ruins of antiquity—an ingeniously simple tool

CREDITS: *the domestic little 19th Century lithograph on the front cover, which introduces our newsreport on today's multibillion-dollar glass industry, is from the Fisher Collection of Alchemical & Historical Pictures, Pittsburgh. For their generous cooperation, we are indebted to researchers in all 4 major areas of the industry: specialty glass, container glass, flat glass and fibrous glass. All photos in this report courtesy of Corning Glass Works, a leader in the field of specialty glass.*

for dating. They've discovered that counting the layers of chemical decay (each 1/30th the thickness of a human hair) on the crust of old buried glass reveals the object's age as surely as tree-trunk rings do for an old oak.

▶ Owens-Illinois researchers (who spend half of the firm's $12 million annual research budget on *pure* research alone) are aiming at upping glass's tensile strength from today's 2% of theoretical to 10%. This may not sound earthshaking when expressed in cold percentages, but it could mean the replacement of steel I-beams with glass ones you couldn't smash with a sledgehammer, and with about half the size and cost of traditional I-beams.

▶ And Bell Telephone Laboratories chemists are creating a whole new *family* of transparent glasses for future electronics applications, simply by heating, to 400°C, ampuls containing arsenic, sulphur and bromine (a far cry from tradition's sand-lime-&-soda mix). What's startling: these glasses are glassy solids only at lower temperatures; at room temperature, they're actually liquids.

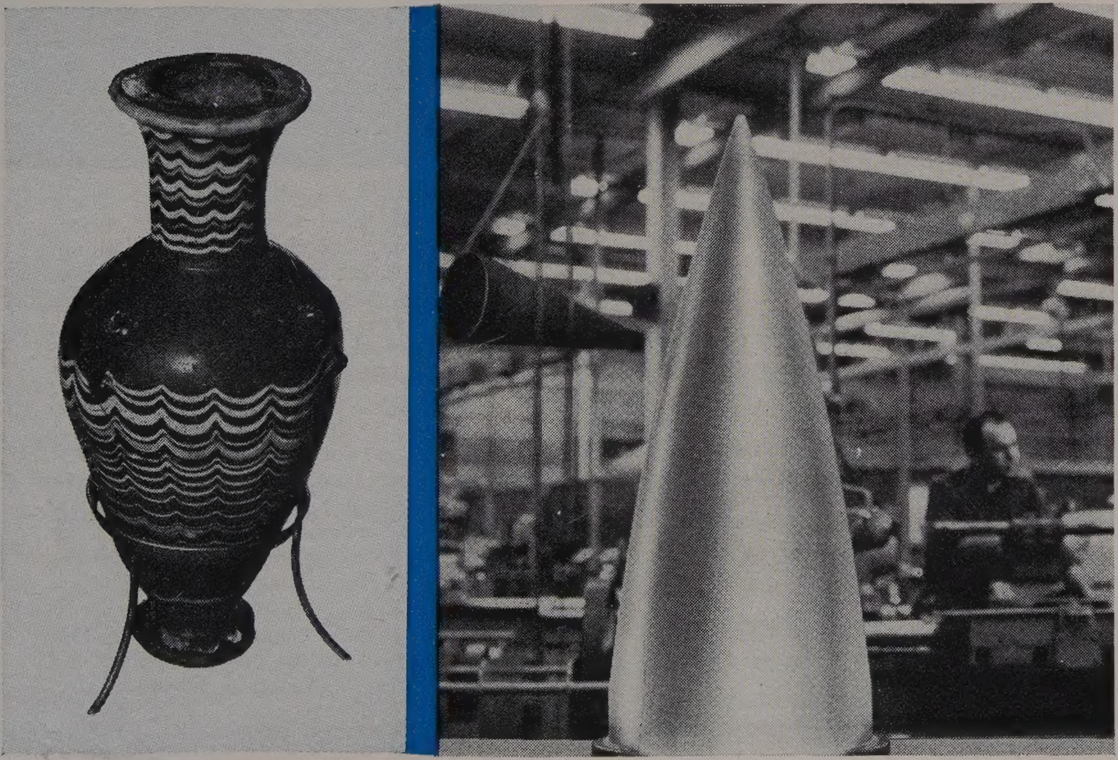
Complex, confusing

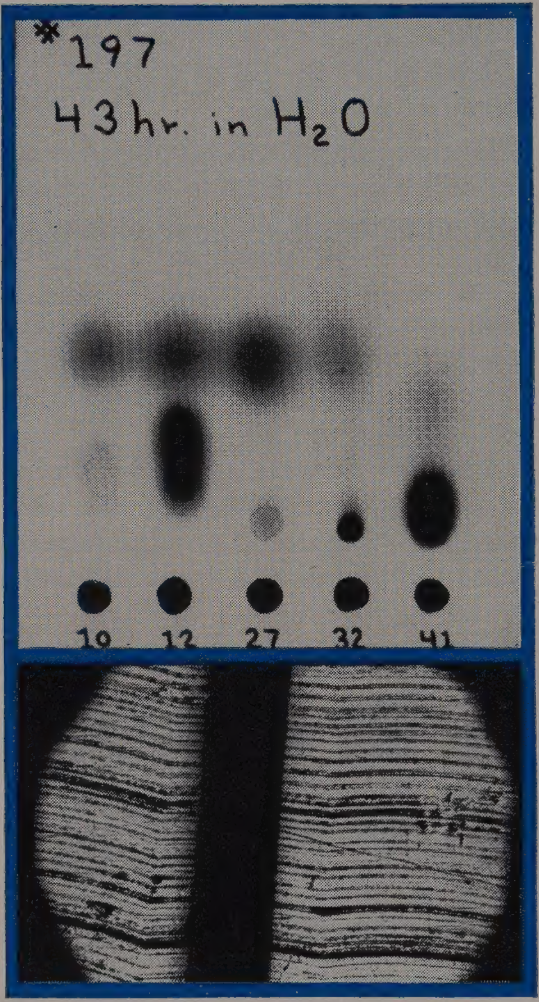
Though people tend to take glass for granted, it is, of course, a complex and confusing substance. Even scientists don't agree as to its definition ("What is Glass?" is the title of dozens of articles in Germany's *Naturwissenschaften,* Russia's *Ukrainsky Silikaty,* Hungary's *Magyar Chem. Folyoirat,* America's *Science,* Britain's *Nature*).

American researchers regard it as "an inorganic mixture of fused ingredients existing as a supercooled liquid"; Europeans include *organic* materials in the mixture as well.

Glass is obtained by melting these materials together at high temperature. The resultant hot liquid, when cooled, becomes rigid without crystallizing—that is, its atoms never get around to arranging themselves into an orderly crystalline pattern. Glass is always in this non-crystalline state,

The possibilities of glass have always intrigued man. He could make glass long before he could smelt iron. Left: a 3500-year-old miniature masterpiece from glass. Right: a missile nose-cone from a new "glass-ceramic."





New developments in glass: Top is chromatogram of 5 ink samples, using a new porous glass ideal for chromatography (but not yet commercially available). Bottom photomicrograph shows layers in glass crust (compare with human hair shown).

no matter how hard and rigid it becomes when cool.

Filling the holes

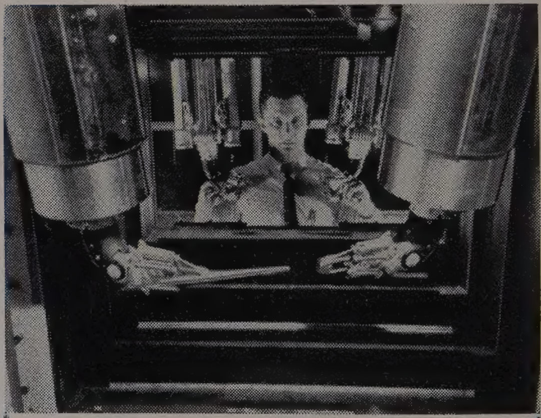
Today, however—thanks to laboratory research on filling the "holes" in glass's non-orderly structure with just about every element in the earth's surface—we have glass products that are light as cork or almost as heavy as iron; strong as steel or fragile as eggshells; soft as cotton or hard as precious stones.

The basic internal pattern of glass, as we've noted, is always that of a liquid. However, U. S. researchers have been able to rearrange these glass molecules by adding "nucleating agents" to the glass batch, then re-heating. The glass becomes a solid: a close-grained super-hard *crystalline* material of a kind never seen in the universe before. In short, a "glass-ceramic."

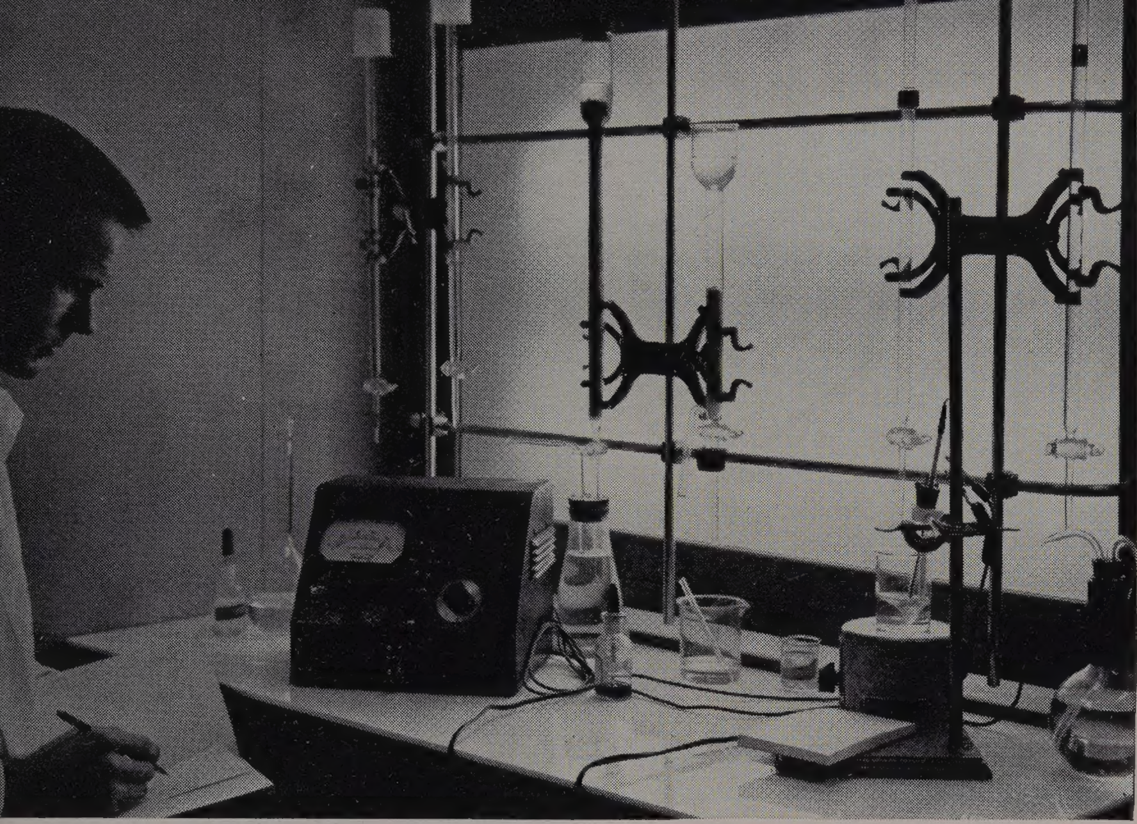
These glass-ceramics, lab-created in answer to technology's demand for materials that can withstand ever-higher speeds and temperatures, retain full strength even when copper melts and steel sags.

Some glass-ceramics will expand, others shrink, others remain *exactly the same size* under heat. Their uses range from nose-cones for guided missiles to "cook-serve-freeze" utensils for the housewife.

At Eastman Kodak, researchers have been busy developing another line of exotic glasses—"rare-earth element optical glasses"—with lanthanum as a key ingredient. These contain no silica at all,



RADIATION-SHIELDING windows made of special non-darkening glass protect nuclear scientists. More humble glass is vital to the work of physicians, dentists and ophthalmologists (think of hypodermic syringes, spectacle lenses, thermometer tubing, medicine bottles, microscope slide covers). In operating rooms, special glass cuts off the intense heat of thousands of watts of light. Chemical glassware plays a major role in blood transfusions, because its composition prevents contamination, makes possible repeated sterilization. And special glass is used in the construction of barrels of "electron guns" capable of developing rays with twice the power given off by all the medical radium in the world.



One of U.S.'s first industrial research labs was in a glass works (1908). Today's glassmakers spend $65 million a year on research by chemists (such as the one above), physicists, physical chemists, ceramists, engineers; are spawning new products at a record rate.

produce lenses without astigmatism. Use: wide-angle camera lenses.

Porous glass articles with, of all things, built-in *ion-exchange* properties are under study at Minnesota Mining & Manufacturing. These strange glassy structures contain such materials as the dioxides of titanium, zirconium and hafnium.

And at the 1961 Pittsburgh Conference on Analytical Chemistry & Applied Spectroscopy, a young Corning "chemist-criminalist" demonstrated what he calls "thirsty glass," ideal for tracing the ink found on mystery notes written in homicide cases.

The glass, 96% silica, contains millions of holes one 6-millionth of an inch in diameter. It drinks up the writing fluid; develops chromatograms in 24 hours; is transparent (hence the chromatograms may be examined optically); can be fixed permanently with acrylic resin for, say, the FBI's records.

Meanwhile, at the National Bureau of Standards, chemists and physicists are attacking the fundamental secrets of glass composition in the light of the increasing use of *infrared* devices in military target detection, fire control, missile guidance and aerial reconnaissance.

For one thing, the effects of small amounts of *water* in the internal structure of glass have been—till now—largely neglected. Unfortunately, the presence of this water is strongly evident in the infrared spectra of practically all glasses. One NBS finding: addition of fluorides in the glass batches will help eliminate the intruder.

Physically fitted

Big changes in glass can be made, of course, even without altering its chemical structure. Two rather extreme physical variations are foam glass and fiber glass.

Foam glass, developed by researchers in 1940, has achieved an enviable reputation as heat insulator. Made into rectangular blocks, this material floats on water, can be cut like wood, is rigid, won't burn. It's produced by mixing finely-ground glass and carbon, which melt to expand into a black foam containing over 10 million inert air cells per cu ft.

Fiber glass is another product that has discarded some of the "traditional" properties of glass. Flexible, soft to the touch, it's now included in more than 30,000 commercial end-products, which gulp down 750 million lbs of the fiber a year.

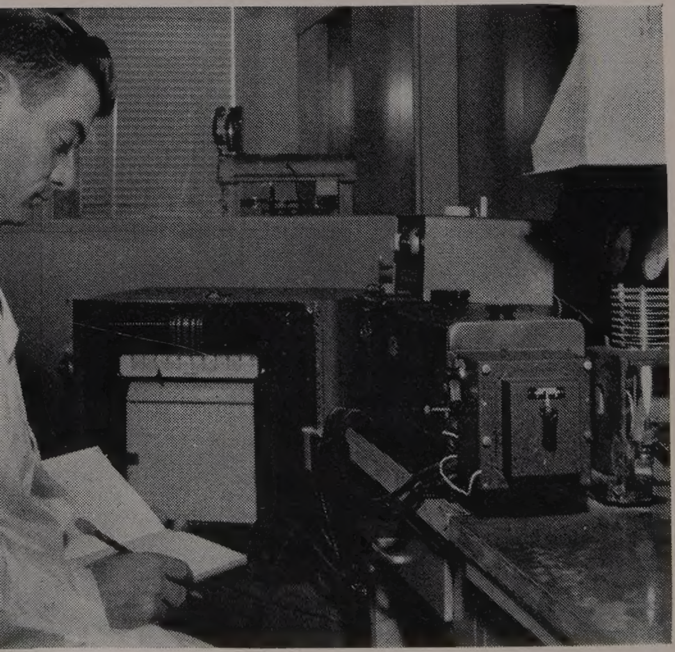
Recent products include polarizing light panels (light diffuses through Fiberglas flakes) and Fiberglas air-conditioning filters coated with hexachlorophene for protection against bacteria.

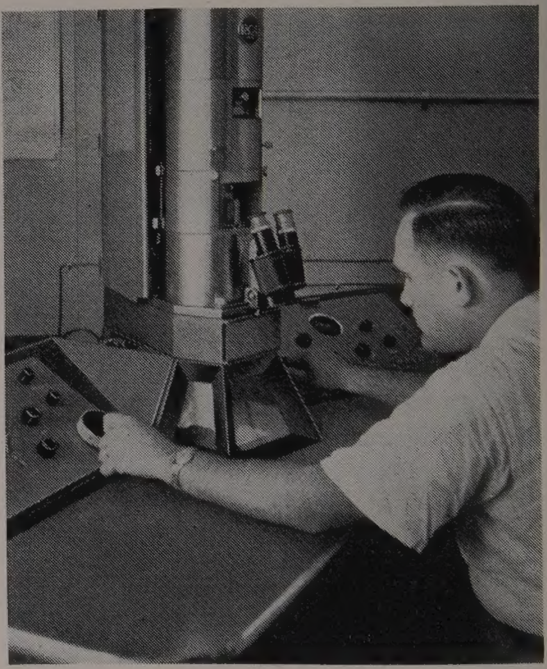
Right now, fiber glass laboratories, probably the most active in the industry's research spectrum, are pushing such projects as the development of silica glass fibers that withstand 3000°F.

Reason: the Space Age, which requires, among other things, a virtually "universal" material that will not burn, corrode, mildew, absorb moisture, sag, or lose resiliency; insulates against heat and sound but not radar; is light as down, but won't sag, pack, shift or settle out of place (causing voids in insulated areas and resultant failure of equipment); won't expand (causing stress in structural parts); won't "dust" under vibration (causing airborne contamination and failure of delicate instruments).

Fiber glass, Johns-Manville lab researchers tell us, seems to approach the demands of this universal Space Age material as closely as anything in sight.

What is glass? its structure? composition? properties? Researchers use variety of approaches, including familiar ones of flame photometry (below) and electron microscopy (at right).



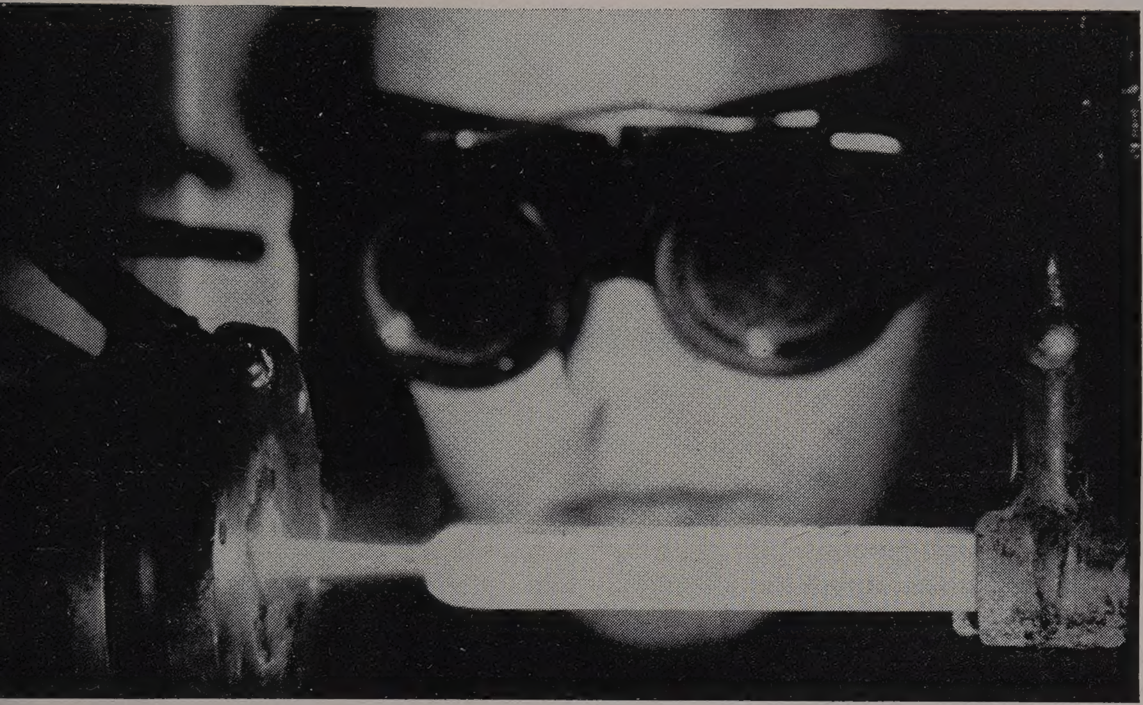


Meanwhile, on earth . . .

Though a MACH 3.0 (2100-mph) jet transport is slated for operation by 1970, life on the crowded earth *below* is probably of more importance to the man on the street—and on the turnpike.

Down here, too, glass figures in researchers' thoughts. They foresee glass as a source of light in highways of wear-resistant phosphorescent glass that will softly illuminate our way by night (glass compositions will directly transform electrical power into visible light).

Other glass men not only predict that both natural and artificial light will be controlled by glass in houses of the future, but that the *same* glass will be energized to cool or heat a room without drafts. (Air will pass through micro-openings of glass whose porosity will be changeable; this



Plasma jet, producing temperatures in excess of 20,000°F, simulates a missile's re-entry temperature; it expedites Corning Glass Works research on fused silica.

will permit control of the passage of cool or warm air to portions of the same room, if desired.)

They also foresee the use of glass-ceramics in ballbearings, heat-exchangers, diesel and gasoline-engine parts. They look to jumbo reflectors of glass to focus the sun's rays into temperatures that may help revolutionize chemical and metallurgical manufacturing methods, permit the development of new substances of unique properties. (Now under consideration: a segmented mirror 200 ft in diameter, to produce 5000°C.)

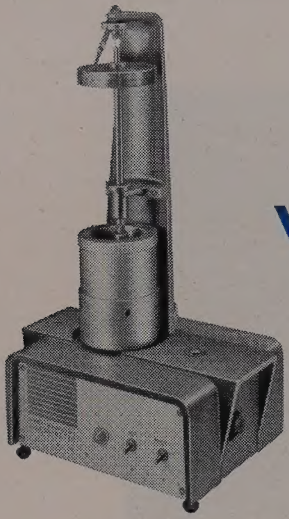
They talk about strong pliant glasses (able to give under stress) as the structural material for lighter automobiles, bridges, trains and ships, the glass parts being fused together without nails or rivets.

Finally, they predict the same malleable material (with the workability of plastics, the heat resistance of glass) as a prime source for parts to replace damaged organs in the human body.

All in all, a pretty lively laboratory future for a material that was being chipped and flaked into arrowheads, knives and razors, in the form of volcanic obsidian, some 75,000 years ago. ■■

RE: INSTRUMENTS—*Galileo and his like-thinking contemporaries initiated a "new experimental philosophy" . . . indeed, a philosophy which recognized the need for new tools, the tools of the experimenter, instruments. These soon gave exciting evidence that here were the means, and here was the way, for soundly and solidly building the structure of science.*

—PAUL E. KLOPSTEG, *Past President of the American Association for the Advancement of Science*



VISCOSITY WITHOUT TEARS

From Fisher comes an improved MacMichael to make accurate measurements more easily

THINGS LIKE a thermostated bath that can be operated at temperatures up to 300°F . . . an adjustable governor that gives reproducible turning speeds of 10 to 38 rpm . . . a working range that makes it easy to measure viscosities of well over *a million centipoises*—these are a few of the features that Fisher Scientific's new improved MacMichael Viscosimeter brings to laboratories in scores of industries.

Rheologists have found earlier Fisher models of the MacMichael indispensable for measuring the viscosity of liquids ranging from water to stiff glues, asphalt and plastics.

Because of the instrument's simplicity and the ease with which measurements are made, one leading industrial scientist went so far as to recommend the MacMichael Viscosimeter as "a basic part of every rheological laboratory."

The Viscosimeter measures viscosity (or apparent viscosity) of either true liquids or non-Newtonian liquids by the rotation method, in "degrees MacMichael" (300 to a circle).

Measurements can, of course, be converted directly into absolute units—centipoises—once the instrument has been calibrated against liquids of known viscosity.

Results are reproducible to ±1° to 2° M, thanks to the close temperature control, reproducible speed and other design features of the new Fisher instrument.

The MacMichael is especially recommended for extremely viscous liquids, and those whose viscosity can't be determined any other way: paints, varnishes, glue, resins, food products, lubricants, dairy products, gelatin, chocolate, heavy oils—to name a few.

Here is a closer look at the new model, a joint product of the Fisher Development Laboratories and the Fisher Instrument Manufacturing Division:

Temperature control—the temperature of the sample is held constant by a revolving thermostated bath. The adjustable thermostat responds to changes of ±1°F, controls a 200-watt ring heater in the bath's bottom, gives stable test temperatures up to 300°F. A Bakelite cover promotes temperature stability by reducing the heat loss from the sample cup and bath.

Reproducible speeds — the motor that rotates the bath and sample cup is easily adjusted for speeds from 10-38 rpm by a conveniently-located calibrated knob. A newly designed governor controls the speed closely for added accuracy.

Standardized plungers —to increase reproducibility, Fisher engineers have standardized the weights as well as the dimensions of the test plungers and spindle. The new plungers are chrome-plated, highly polished; they sternly resist size-altering abrasion.

Precise leveling —a "bull's-eye" level and two adjustable feet facilitate critical leveling of the spindle.

Easy-reading scale — readings are now made from a dial graduated on the side from 0° to 290°M, conveniently read by a seated operator.

Now, a look at procedure. The MacMichael Viscosimeter measures viscosity by determining the torque exerted on a standard plunger suspended on a uniform wire in a liquid rotated at constant speed.

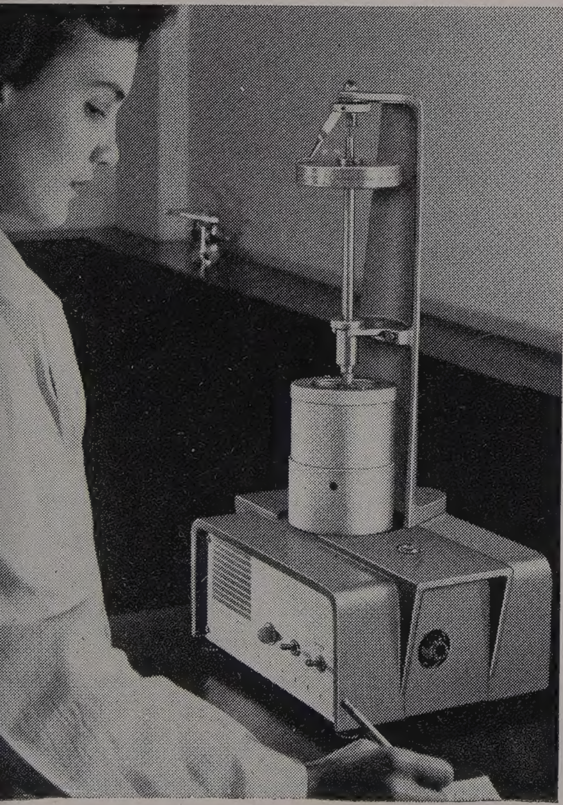
The plunger and supporting spindle turn until the drag of the rotating sample is just balanced by a restoring force in the twisted wire. The spindle then stops, and the extent to which it has turned is read from the dial (graduated in °M).

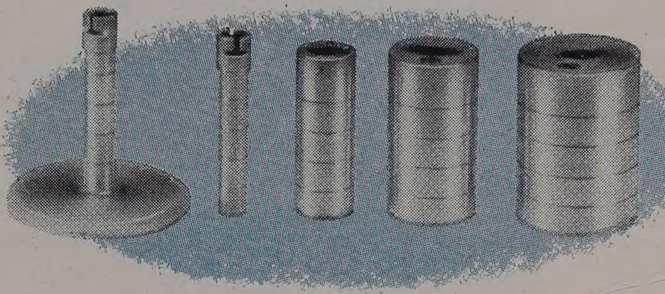
Two interchangeable plungers are supplied with the MacMichael: a cylinder, 1 cm in diameter, for highly viscous liquids, and a disc-shaped plunger for liquids of low viscosity.

To increase the effective diameter and surface area of the cylindrical plunger, the operator can slip one of three adapters—2, 3 or 4 cm in diameter—over the 1-cm shaft. All plungers are graduated for immersion of 1, 2, 3 or 4 cm.

Because of the variety of plungers, sample cups and sample depths available with the MacMichael, one torsion wire can measure a wide range of viscosities. To *increase* this range, wires of varying stiffness are available.

The MacMichael Viscosimeter's simplicity, accuracy and range (over a million centipoises) give it an important place in any rheology lab.





Left to right: disc-shaped plunger, standard cylindrical plunger, 3 adapters that fit over basic cylinder.

Wires are available in B & S gauge sizes from 16 to 34, either certified or uncertified (certified wires have a certificate showing their torsional resistance in gram-centimeters per °M as determined in the Fisher testing laboratories).

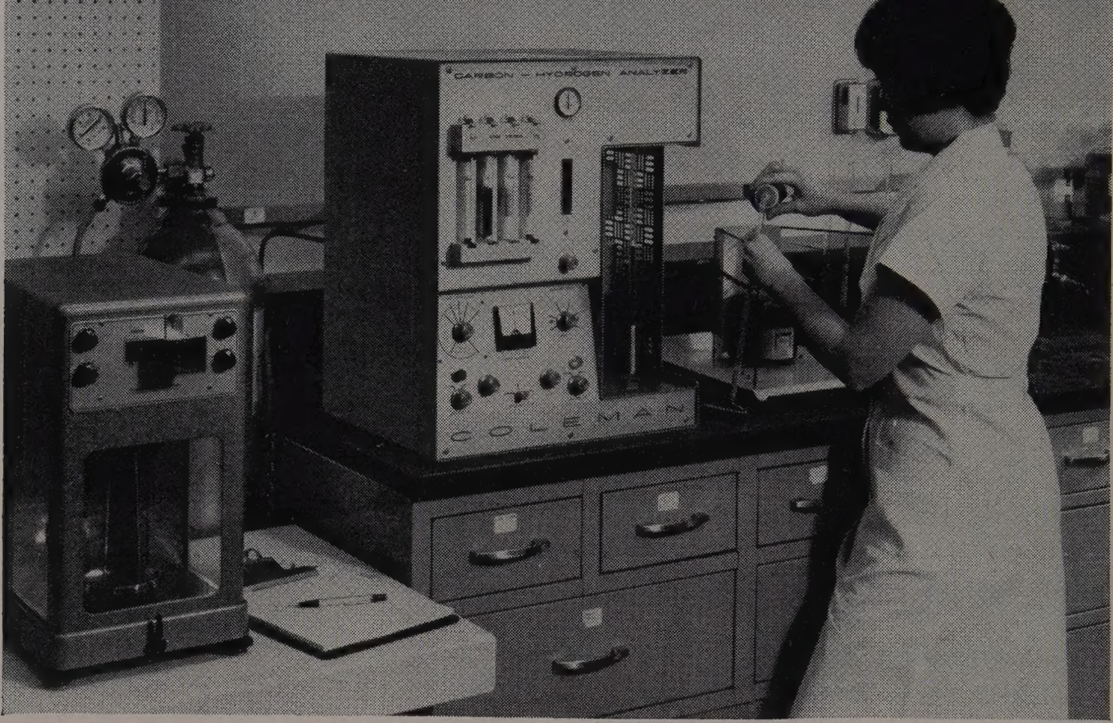
The base of the new instrument is extremely stable, with convenient carrying handles on both sides. The 3 simple controls are all located on the front of the base: power switch for heater; rotation-motor switch; heater pilot light.

A knob for adjusting the motor governor is on the side, protected from accidental changes by the handles.

The instrument is durable cast aluminum, easy to clean. Its spindle and plungers (attached to the spindle by a bayonet lock) are easily removed, as are the torsion wires.

▶ The improved MacMichael Viscosimeter, for operation on 115-volt 50/60 cycle a-c, is supplied with 4 uncertified wires of any specified B & S gauge (22, 26, 30 and 34, unless you request other sizes); disc plunger; 1-cm cylindrical plunger; heating bath; large sample cup; small sample cup; Bakelite cup cover; and full instructions. Price: $525.

Certified wires are $7.50 each; uncertified $4 each (B & S gauge sizes available are these: 16, 18, 20, 22, 24, 25, 26, 27, 28, 30, 32, 34). Auxiliary cylindrical plungers are $25 for the 2-cm diameter; 3-cm, $30; 4-cm, $37.50.



IN CARBON-HYDROGEN ANALYSIS . . .

No more alchemy

IT'S BEEN a long time since a chemist was accused of witchcraft because he could perform a difficult analysis, but the "art" in an experienced analyst's technique *can* mean the difference between a successful analysis and a lost sample.

Now Coleman—whose automated micro-Dumas Nitrogen Analyzer has been such a notable success—has built the art of making a Pregl micro-combustion analysis into a new *automatic* Carbon-Hydrogen Analyzer.

No alchemy needed—with this new apparatus an average technician can analyze organic solids and liquids for both carbon and hydrogen with an accuracy of ±0.2% . . . in ½ to ⅓ the time required for a conventional Pregl microanalysis.

The entire analysis is automatic, from the moment the operator fits a quartz combustion tube containing the sample into the apparatus and turns the programming timer to "START" until he slips out two absorption tubes (containing the carbon dioxide and water formed by burning the sample) and weighs them.

What's more, the Analyzer can be used for *both* micro and semi-micro samples, from 2 milligrams up to 50 mg or more.

The apparatus will handle most organic compounds which pyrolize between 700° and 1100°C. Typical samples: all types of hydrocarbons, including aviation fuels; compounds containing oxygen, nitrogen, sulfur, halogens; many metal esters. It is ideal for analyses of foodstuffs and pharmaceutical products.

A standard combustion cycle takes only 8 minutes. Any stage in the cycle can be extended and the program itself changed.

The C-H cycle

In the Coleman Carbon-Hydrogen Analyzer, solid and liquid samples are burned in a current of pure dry oxygen. Sulfur, halides and nitrogen oxides are removed; the water (from oxidation of hydrogen) and carbon dioxide (from the carbon) are absorbed; and the gain in weight of the absorption tubes is noted. The C and H content of the sample and the C/H ratio are then easily calculated.

Solid samples are weighed into a disposable aluminum boat and placed in the

In one industrial lab (left), the C-H analyzer made it possible to run 20 analyses in half the time of 12 standard Pregl tests.

quartz combustion tube with a packing (copper oxide, platinized asbestos catalyst, silver gauze, in the standard Pregl procedure—or any materials the analyst may prefer) that assures complete combustion and removes sulfur and halides. Liquids can be put in a glass capillary or deposited directly on the copper oxide packing with a syringe.

The combustion train is first purged with a 100 cc/minute flow of pure oxygen. The flow is then automatically shut off while two furnaces move out to pre-heat the copper oxide in the tube. (If the sample is volatile, cooling tongs can be used to hold its temperature down at this stage.)

Combustion takes place in two steps: an initial step with the oxygen flowing slowly, and a final step with a full flow of oxygen, which sweeps the products of combustion out into the absorption train, where they are absorbed or removed. (Nitrogen oxides are taken out in a "scrubber" between the water and carbon dioxide absorbers.)

Finally the furnaces withdraw and the flow of oxygen is continued long enough to cool the tubes so that they can be removed and weighed. The absorption tubes hold enough reagent for about 40 determinations. The combustion tube packing will last for about 25.

A "CYCLE DELAY" switch enables the operator to interrupt this program at any point, for as long as is necessary to assure complete combustion. An auxiliary timer can be used to extend the final combustion stage for up to 5 minutes.

The power input to the two furnaces is controlled by dials on the front of the apparatus, and their temperatures shown by built-in thermocouples which read out on a direct-reading pyrometer.

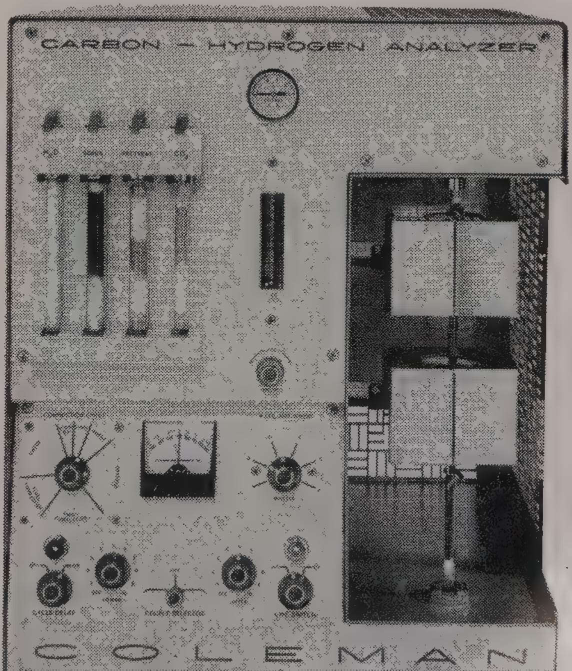
The Model 33 Carbon-Hydrogen Analyzer is self-contained (except for the oxygen supply and main regulator), takes only 18″ of bench space. It uses 750 watts of 115-volt 50/60 cycle a-c, requires a balance such as the Semi-Micro Gram-atic® or Mettler H-16, with a 20-gram capacity and readability of at least 0.1 mg.

▶ Fisher supplies the Carbon-Hydrogen Analyzer complete with 3 quartz combustion tubes, 100 disposable sample boats, 2 absorption tubes, 2 gas scrubbing tubes, tongs for the absorption tubes, copper tubing for the oxygen supply line, and packing materials for combustion and absorption trains, but without oxygen or oxygen regulator. Price: $2150.

Cooling tongs, with aluminum cups that can be filled with ice or dry ice and used to cool the sample during pre-heating of the copper oxide, are $15 a pair.

Coleman's copper oxide "fines," described on page 52 of this issue, will also be useful with starches, flours or other powdered samples and to absorb liquids.

Check "Coleman Carbon-Hydrogen Analyzer" on the reader-service card for a brochure describing this important new analytical instrument, its accessories, and its operation.



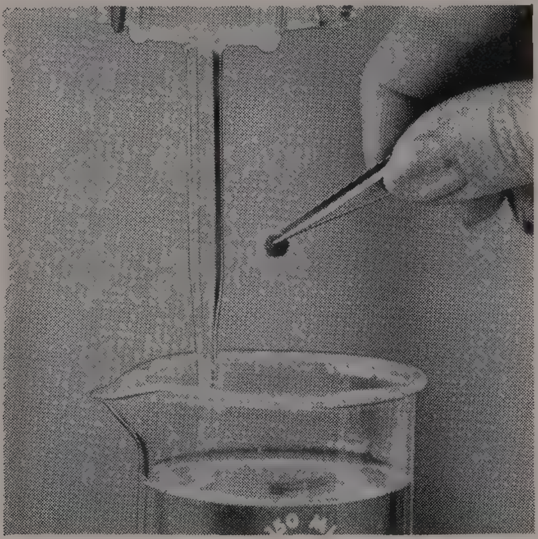
Note (right) how all operating controls are conveniently located on the front of the new C-H analyzer.

REAGENT SHELF

METAB indicator tablets expedite titration

SIMPLIFIED is the word for what has happened to acid-base and metal titrations thanks to a new indicator that Fisher chemists are manufacturing in stable *tablets,* ready to dissolve and use.

METAB* Indicator Tablets not only serve for acid-base titrations (*yellow* in acid solution, *blue* in basic); they are a nearly "universal" metallochromic indicator for chelometric titrations of most metals.



Endpoints are extremely sharp, and METAB should be effective with all kinds of chelating agents.

Each METAB contains 0.5 mg of the sodium salt of 3, 3′-[bis-N, N′-di (carboxymethyl) - aminomethyl] - thymolsulfonphthalein, formulated with specially selected binder. Before being tableted, every lot of indicator passes rigid quality-control tests for absence of interfering organic impurities, and for sensitivity as a metallochromic indicator.

In its highly-purified tablet form, METAB *indicator remains stable indefinitely,* if the bottle is kept closed. The tablets are readily soluble in water, though the active ingredient is insoluble in absolute ethanol and ether. One tablet is enough for a titration.

▶ Fisher METAB Indicator Tablets are $5.20 for a bottle of 100 tablets ($4.70 a bottle in the 6-pack). Catalog number: M-293. *For a bulletin giving the pH color changes and chelometric endpoints for 14 metals, check "*METAB *Tablets" on the reader-service card.*

Indicarb gives 50% more absorbing capacity for CO_2

A NEW SOLID absorbent for carbon dioxide, *with an absorptive capacity averaging 50% higher than that of other commercial absorbents,* has been announced by another Fisher reagent development team.

Fisher's new INDICARB* CO_2 absorbent is manufactured in three closely-controlled particle-size ranges, to suit the requirements of the variety of analytical apparatus now used in steel labs and elsewhere.

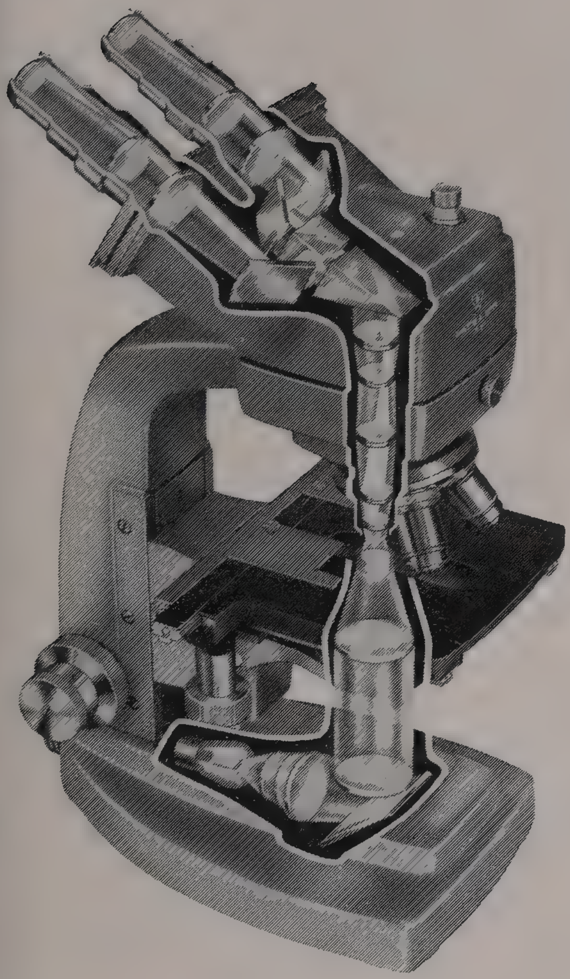
No call for tricky mixing and packing techniques . . . simply pour INDICARB into the absorption tube, tap it lightly to settle the particles, insert the usual glass-wool plug, and you're ready to begin an analysis.

INDICARB comes in dark purplish-brown granules that change to pinkish white as their absorbent capacity is exhausted. The line of color contrast is extremely sharp, showing clearly when the INDICARB must be replaced.

▶ Fisher INDICARB Carbon Dioxide Absorbent is manufactured in 3 mesh ranges: 6-10 mesh (cat. no. 5-751-10A); 10-20 mesh (5-751-10B); and 20-30 mesh (5-751-10C). Prices are the same for all sizes: $5.75 per 1-lb bottle, with substantial reductions when ordered in case lots of 12, 48 or 144 bottles.

**Fisher Scientific Company trademark*

NEW FAMILY OF MODULAR MICROSCOPES THAT LEUWENHOEK WOULD'VE LOVED



DynaZoom

MAGNIFICATION can be doubled without changing lenses or eyepieces . . . without refocusing . . . without disturbing the illumination . . . without losing the field of view . . . without changing the working distance—when you use Bausch & Lomb's "DynaZoom" laboratory microscopes.

"DynaZoom" is B&L's family name for 4 new series of top-quality microscopes that embody noteworthy optical and mechanical innovations. Major innovations:

1. *The new system of adjustable auxiliary lenses* that enables the user to vary the magnification continuously over a range of 1x to 2x. (B&L calls this "MicroZoom.")

2. *The modular design of the microscope itself* that enables the user to select the most effective combination of body, objectives, eyepieces, stages, condensers and illumination for the work at hand.

This is MicroZoom

Since the days of Leuwenhoek, microscopists have had only *two* ways of changing magnification: use a different objective, or use a different eyepiece. Either meant an abrupt shift in appearance of the specimen on the slide when the lenses were changed.

With B&L's MicroZoom system, the magnification changes smoothly and continuously, with the specimen *always in focus.*

When an eyepiece micrometer is used to measure structural details, the MicroZoom knob can be used to bring the graduations on the eyepiece scale into exact correspondence with the divisions of the stage micrometer. *There is never any doubt about the precise calibration of the scale.*

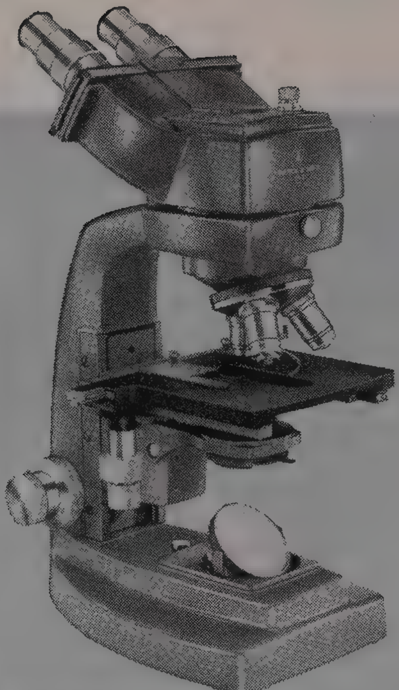
The MicroZoom system consists of three lenses, one fixed and two moving in precise mechanical coordination, so that the magnification varies continuously without changing the focus.

The microscope's total magnification is given by the power of the objective times the power of the eyepiece (as usual), multiplied by the setting on the MicroZoom dial. This is graduated in 0.1x intervals from 1.0x to 2.0x. Settings can be accurately reproduced.

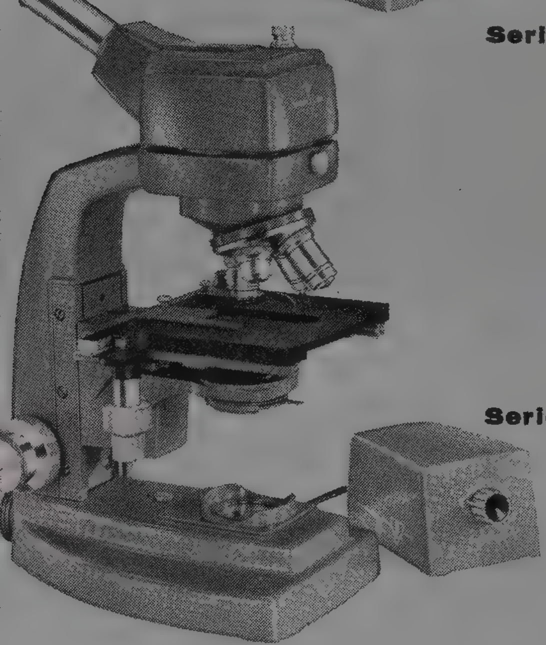
MicroZoom may eliminate the need for purchasing auxiliary lenses. The 43-power objective can be used at 50x, 70x . . . anything up to 86x.

Modular design

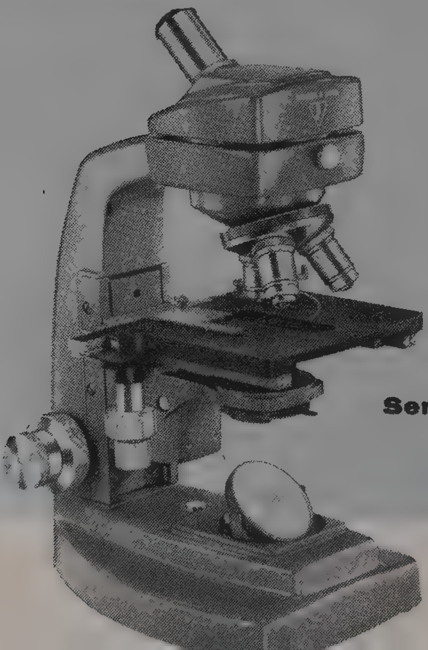
The other secret of the DynaZoom family's versatility is modular design.



Series T



Series Z



Series F

▶ *Stand*—The same sturdy stand is used in all DynaZoom microscopes. Focusing is accomplished by moving the stage and slide; the body of the microscope doesn't move, so there is no inconvenient shift in the user's eye-position.

Concentric focusing knobs (the fine adjustment graduated in microns) are low on the *side* of the stand, literally at the microscopist's fingertips. An automatic stop and safety clutch protect the objectives, slide, and focusing mechanism.

The base is recessed to take any of the interchangeable DynaZoom illuminators.

▶ *Bodies*—The stand accommodates any of 6 interchangeable inclined monocular, binocular, or (on special order) photomicrographic bodies. All can be rotated through 360°, used in any position.

Features of the new body design include high-quality first-surface aluminized mirrors in place of the usual prisms, reducing light losses; a clear glass cell below the eyepiece that keeps dust out of the optical train; and a new interpupillary-distance adjustment that keeps all objectives focused for all viewers.

In binocular models, the eye-tubes are parallel for easier use; the left eyepiece focuses separately.

▶ *Objectives*—DynaZoom objectives are color-coded for quick selection; they are mounted in sure-centered, ball-bearing double, triple or quadruple nosepieces.

The three most commonly used powers are 10x, 43x and 97x (for oil immersion). The numerical aperture of the 97x objective has been increased to 1.30, and the 43x objective has increased contrast and an exceedingly flat field. The auxiliary MicroZoom system increases the effective power of all objectives up to 2x.

▶ *Eyepieces*—All models are supplied with a 10x Huygens eyepiece. A 5x Huygens of new design, wide-field eyepieces, and other types are also available.

▶ *Stages* — All stages are mounted on a ball-bearing focusing slide. Fisher stocks microscopes with the three most popular types of stages: a *plain* rectangular platform, 145 x 125 mm, with spring clips to hold the slide, and both ungraduated and graduated *mechanical* stages. Controls are concentric, below the stage for easier operation. Even the extreme corners of a standard slide can be scanned readily.

▶ *Substage Condensers*—DynaZoom microscopes have two types of substage mounts: a simple mount with iris diaphragm, and a precentered rack-&-pinion.

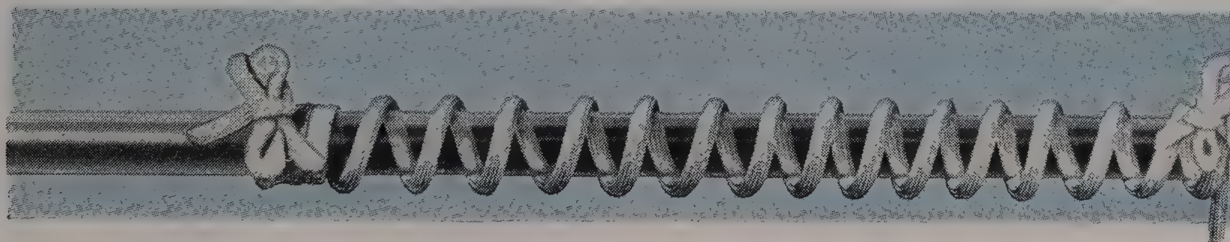
An Abbe condenser with separable elements, and a variable focus condenser are both available. These have a numerical aperture of 1.30 to match the 97x oil-immersion objective. They also come with a sliding focusing tube, for use on the simple substage mounting.

▶ *Illumination*—The base of the DynaZoom stand is designed to hold a 55-mm plano-concave illuminating mirror, the new B&L "Opti-lume" illuminator, or a built-in adjustable-intensity Koehler-type source which Fisher can supply to order.

Opti-lume illuminators can be used separately, with the mirror, or mounted directly on the base of the microscope, where they give over 300% more light than other comparable illuminators. There are two models: one for binocular microscopes, with an aluminized reflector, special spherical condenser, and choice of blue or frosted-glass filter, for $13; and another without the special condenser or reflector, for monocular models. With a *blue* filter, this is $8.50; with a *daylight* filter, it is $9.50.

Fisher stocks 24 models in three of the four DynaZoom series: *Series T*, with inclined binocular body and MicroZoom optical system; *Series Z*, with inclined *monocular* body and MicroZoom optics; and *Series F*, with inclined, constant-power monocular body. (A fourth series, *Series P*, for photomicrography, is obtainable on special order.)

Within each series, models differ in the combination of stage, condensers, objectives, etc., supplied. All are described in a 24-page catalog from Fisher. *For your free copy, check "DynaZoom Microscopes" on the reader-service card.*



WRAPS UP
heating problems

IT'S GETTING easier all the time to put uniform heat exactly where you want it—beaker, container, column, pipe, or the most exotically-shaped, complex laboratory assemblies. Fisher's newest heating aid, from Glas-Col, is a notably flexible "heater."

Easy to use, and as flexible as any appliance cord we've ever seen, Cal-Cord comes complete with cord and plug, eliminates troublesome loose terminals on the ends.

Fisher has both Cal-Cord 400 (for 400° C specifications), woven with long-lived glass fabric insulation, and Cal-Cord 600 (for 600°C specifications), woven with durable quartz fabric.

Cal-Cord 400	3 ft	120w, 115v	$ 9.00
	6 ft	240w, 115v	15.00
Cal-Cord 600	3 ft	300w, 115v	$13.75
	6 ft	600w, 230v	19.50

▶ Suggestion: ideal companion for Cal-Cord is Fisher's Stepless-Input Controller—a compact (2½" x 3" x 3") timer that automatically controls power input to flask heaters, mantles, water baths, heating tapes, carries full-rated load of 1500 watts, 115 volts. Price: $15.75.

WATCH THE PEAKS—Professors Joseph A. Feldman and Mitchell L. Borke explain gas chromatography to pharmacy students in graduate class at Pittsburgh's Duquesne University. On table: Fisher Gas Partitioner model 25.

GAS CHROMATOGRAPHY GOES TO SCHOOL

THE SCENE is a university classroom. The course is a graduate one: "Techniques in Pharmaceutical Research." A student walks up front, lights a cigarette, blows into a syringe. The instructor injects the syringe into a Fisher Gas Partitioner Model 25, and in 4 minutes a recorder shows the presence of CO_2 and (horrors!) CO in the whiff of smoke.

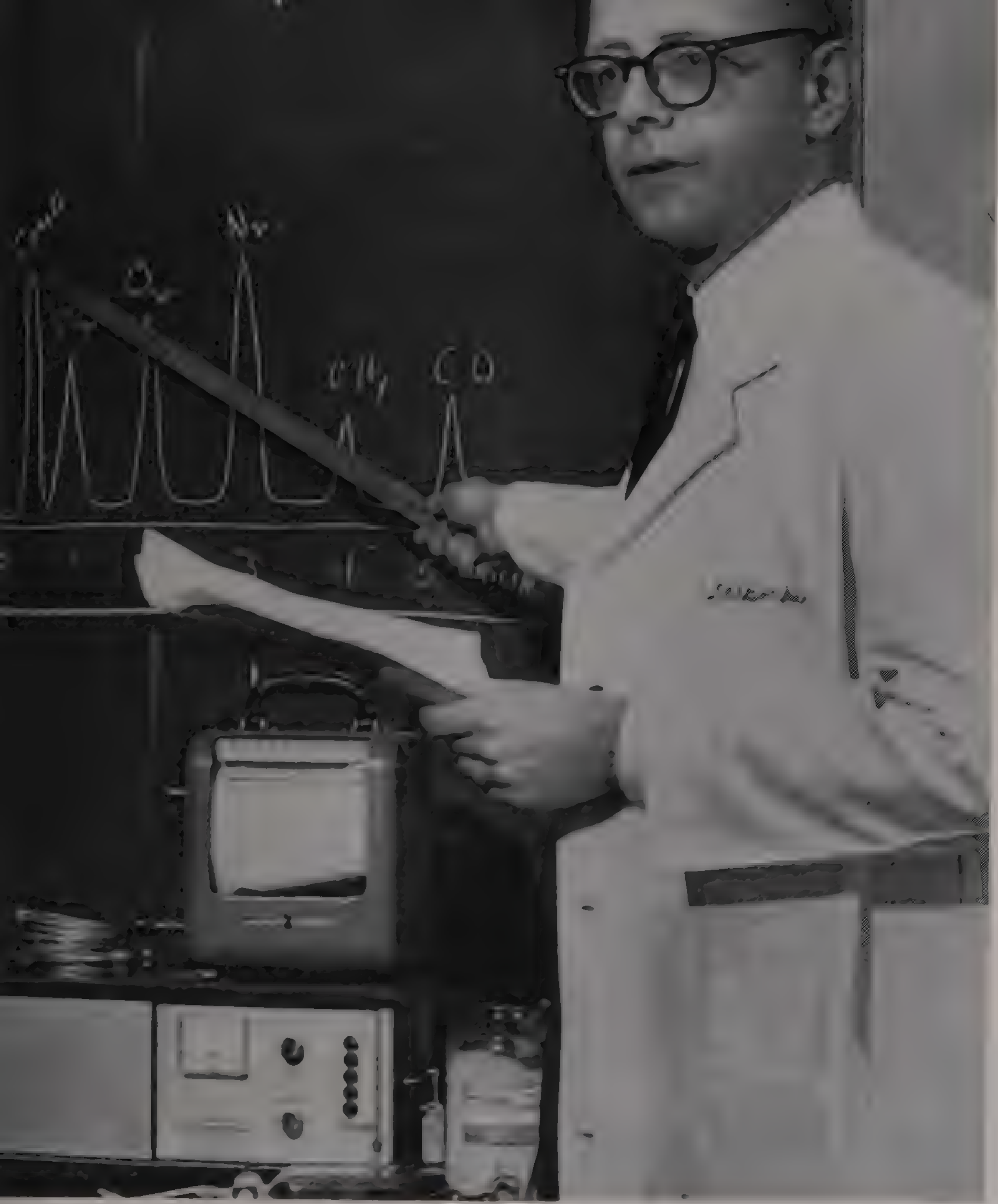
Thanks to an imaginative use of sensitive yet moderate-priced instrumentation by their instructors, today's students are getting a sharp first-hand look at gas chromatography—that vital industrial and clinical research and analytical tool.

TODAY'S STUDENTS *get a firm grounding in the theory and, where budgets permit, the practice of a wide variety of instrumental methods of analysis, in a gamut that may include colorimetry, fluorescence, turbidimetry, nephelometry, spectrophotometry (visible, UV, infrared), spectrography, flame photometry, x-ray methods, mass spectrometry, refractometry, interferometry, polarimetry, radioactivity, electroanalysis, polarography, titration (potentiometric, amperometric), coulometry, pH measurement, even—here and there—nuclear magnetic resonance spectroscopy. Subject of this two-page spread: gas chromatography in the classroom.*

For example, the compact Fisher instrument ($450) analyzes a mixture for oxygen, nitrogen, carbon monoxide, carbon dioxide and methane in 4 or 5 minutes.

The sample is flushed through the Partitioner with safe inert helium. The sample's components travel through the instrument's two chromatographic columns at different rates, are separated before they leave the instrument.

As each component emerges, it is "seen"



by a detector, producing an electric signal which is plotted by a strip-chart recorder. The peak height gives the concentration.

At Duquesne University, each student performs individually designed experiments with the Model 25, making his own chromatogram and calculating such things as % separation of the various peaks, relative peak sharpness, number of "theoretical plates."

The school lab may already have a suitable recorder, such as the portable sensitive Fisher Laboratory Recorder. As for samples, synthetic gas mixtures made up to any composition requested, complete with quantitative analyses, are available at moderate cost from Matheson Co., Box 85, East Rutherford, N. J.

▶ *Fisher* can supply teachers with a 12-page illustrated brochure on the Fisher Gas Partitioner (check the reader-service card). *Teachers* can "take it from there" in devising instructive experiments for the classroom.

Beacon-light for analysts

FLUORESCENCE is one light that's no longer hidden under a bushel.

Atomic scientists, searching for a safe place to dump nuclear wastes, are using fluorescent dyes to trace deep-ocean currents (Johns Hopkins researchers used the trick to follow waste circulation in Baltimore harbor).

Clinical and biochemical laboratories use fluorometry to determine adrenalin, transaminase, various steroids, hormones, vitamins.

Agricultural chemists use it to measure insecticide residues.

Industrial analysts find it the most sensitive way to determine many metals (it's standard for uranium).

▶ *Now, so that chemists can take full advantage of the tremendous sensitivity of these fluorometric methods (100 to 1000 times that of colorimetry), Fisher makes available two ultra-sensitive, easy-to-use Turner fluorometers: the Model 110 for manual operation, the Model 111 for automatic operation with a recorder.*

Both instruments give a full-scale deflection for 2 parts per billion of quinine sulfate. Both can also be used for nephelometric measurements (turbidity checks of drugs, beverages) down to a *fraction* of a part per million.

Designed on the double-beam "optical bridge" principle, these instruments measure the difference between the fluorescent light emitted by a sample and direct light from a calibrated reference beam.

The result: extreme stability, because light-source variations cannot affect the light balance (sample and reference beams are affected alike).

Model 110—the manual model—is a null-reading instrument. The amount of light needed to balance the fluorescence of the sample and null a meter is read from a graduated dial, which controls a cam in the reference beam.

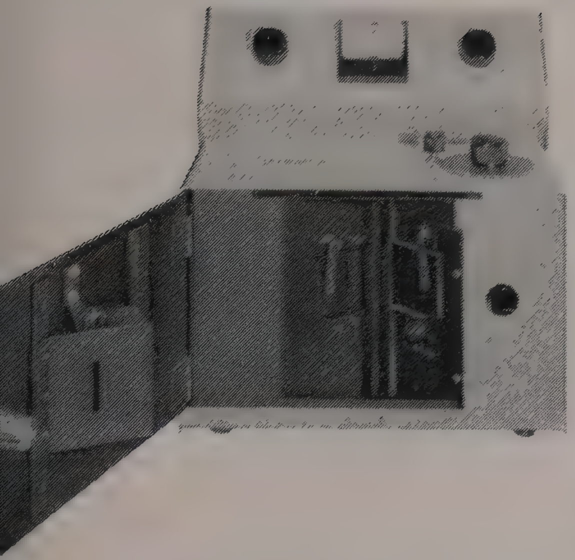
With Model 111, this balance is maintained *automatically* and continuously by a servo-mechanism.

Result: Model 111 is *direct-reading* and, used with a millivolt or milliamp recorder, is made-to-order for continuous-flow analyses and for such things as mass-flow and dispersion studies of air or water pollution. (NOTE: Fisher's portable, 1-mv laboratory recorder is a perfect companion.)

As the photograph (*left*) shows, the fluorometers are compact, convenient.

A "primary" filter (in the clip at the right) passes only the ultraviolet wavelengths used to excite fluorescence in the sample. A "secondary" filter (left) then takes out the excess UV, transmits the fluorescent light from the sample to a photomultiplier. A range selector (below the primary filter) gives the operator a choice of sensitivities: 1x, 3x, 10x, 30x.

It's easy to use the Model 110. Just insert the sample, close door, null meter, and read fluorescence dial (the 111 does it all automatically).



By changing filters, cuvets, you up the Fluorometer's versatility manyfold. Doors are also interchangeable, expedite paper chromatography.

The sample, in an ordinary test-tube,* goes in the holder on the interior of the door. Close the door, and the sample's *automatically* positioned. The door latch acts as a protective switch: open the door, and the photomultiplier is de-energized; close the door and it's back in operation.

The standard door shown in the photograph comes with the Model 110. It can be interchanged with other accessory doors that hold uranium-fusion pellets ($45); paper chromatography strips ($275); or continuous-flow cuvets ($150 with a 5-ml cuvet; $160 with a 20-ml size; $145 with a 1-ml size).

A conversion kit for the standard door ups sensitivity about 10 times, is $55.

A micro-cuvet adapter is $14. Other adapters enable the continuous-flow doors to take cuvets of different sizes.

The Model 111 Automatic Fluorometer comes *without* a door; the purchaser orders whichever door suits his work best.

Nephelometry, too

Either model of the fluorometer can also be used as a nephelometer, to measure the light scattered by a cloudy or turbid sample.

You merely move the secondary filter to the primary clips (this eliminates any interfering fluorescence); put a piece of clear glass in the regular secondary spot to protect the photomultiplier from dust; use a square cuvet.

Much of fluorometry's tremendous versatility comes from the analyst's ability to excite the sample with light of different wavelengths and measure fluorescence of different colors.

The standard lamp and the primary filter supplied with both models gives a narrow band with a peak at 360 millimicrons. The lamp uses only 4 watts, so that there is no problem of sample deterioration from over-exposure to UV. For work at 245 mμ, there is a moderately priced ($4.20) quartz lamp, and filters and quartz cuvets to match.

A boxed set of 11 other filters, supplementing those supplied with the instrument, is available for $55.

The controls are easily accessible on the top and front of the fluorometer. In routine use, the graduated "FLUORESCENCE" dial is set at zero with a reagent blank in the sample holder. If the fluorescence of the reagents is high, a "dummy cuvet" (a black plastic rod), supplied, can be used to get an "absolute" zero setting.

Both models are housed in sturdy steel cabinets with two-tone green enamel finish. The photomultiplier is protected from stray light by a black anodized aluminum inside finish. Both operate on 115-volt 50-60 cycle a-c.

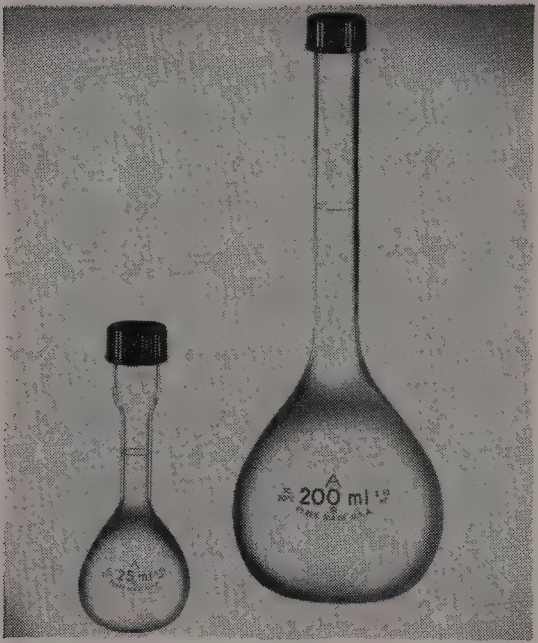
▶ The Model 110 Turner Fluorometer from Fisher, designed for manual operation, comes with standard door; primary and secondary filters; dummy cuvet; set of 5 matched Pyrex-brand glass cuvets; 2 general-purpose lamps; dust cover; and easy-to-follow instructions, for $985.

▶ Model 111, with connections for a recorder or direct-reading automatic use, comes from Fisher with filters, lamps, dust cover, and complete instructions, but without door or cuvets. Price: $1475.

Check "Turner Fluorometers" on the reader-service card for detailed information on both Model 110 and 111, and the complete line of accessories.

Matched cuvets are needed only at highest sensitivity.

Flasks that never flip their lids



CHANCES ARE this may well be an unbeatable laboratory combination for some time to come: a standard design flask of rugged Pyrex brand glass, meeting Class A capacity tolerances (as specified in National Bureau of Standards Circular C-602), *plus* a new Bakelite screw cap that will never pop off or freeze.

And—these flasks, complete with their cap closures, cost from 40 cents to $1 less than similar flasks with *glass* stoppers, or even class B tolerance flasks!

The screw cap has a cone-shaped liner of inert polyethylene that hugs the flask neck, seals it tight, insures leakproof closure, prevents contamination by most common reagents (even alkalies can't freeze it). The cap keeps dust and dirt off the flask lip during storage, absorbs much of the shock should the flask be upset.

In addition, the 25 and 50-ml sizes have an expanded open end to facilitate transfer of crystals, salts, powders.

Capacity, ml	Tolerance, ml	Quantity per pkg	Price, each item	Price per pkg	Price per pkg in assortments of		
					20 pkg	50 pkg	100 pkg
25	±0.03	12	$2.50	$27.00	$25.65	$24.30	$22.95
50	±0.05	12	2.70	29.16	27.70	26.24	24.79
100	±0.08	12	2.80	30.24	28.73	27.22	25.70
200	±0.10	12	3.35	36.18	34.37	32.56	30.75
250	±0.12	12	3.50	37.80	35.91	34.02	32.13
500	±0.15	12	4.50	48.60	46.17	43.74	41.31
1000	±0.30	6	5.50	29.70	28.22	26.73	25.25
2000	±0.50	6	6.75	36.45	34.63	32.81	30.98

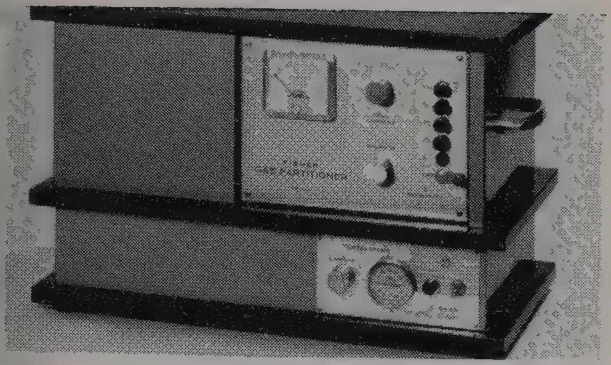
"Fines" simplify nitrogen determinations — just fine

LARGER SURFACE AREA — hence more ready release of oxygen for complete combustion of hard-to-burn samples—*that's the news in the Cupric Oxide "Fines" that Coleman has just developed for its popular Nitrogen Analyzer.* (This instrument was first announced here, vol. 28, no. 3.)

The new material will also be useful in many analyses with Coleman's new Carbon-Hydrogen Analyzer (announced on page 42, this issue) and other micro-combustion procedures.

Sample dispersion: there's no problem with the large size of low-nitrogen samples, such as clay and powdered rock, when you use the new "Fines." No sample boat needed—just mix the "Fines" with the sample, pour directly into the sample area of the combustion tube.

▶ Fisher offers the new Cupric Oxide "Fines" (all particles passing a No. 45 sieve) at $6 per lb.



UNDER CONTROL

popular Fisher Gas Partitioner gets convenient temperature control

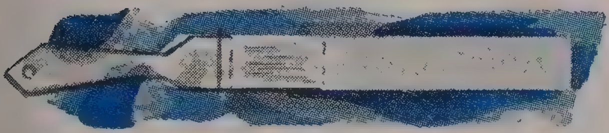
CALIBRATION ERRORS caused by temperature fluctuations in the surroundings are a vexing problem in many labs that use a Model 25 Gas Partitioner for analyses by gas chromatography. The new Fisher Thermal Stabilizer solves the problem, fast.

The Stabilizer is a thermostated air bath that fits under the Partitioner and is maintained at a temperature of 50° to 60°C by an adjustable regulator. Heat from the bath holds the thermal conductivity detector in the Partitioner 5° to 10°C above the highest temperature likely to occur in the lab.

Result: the detector is always at the same temperature. Calibration curves can be drawn for that temperature and used for all analyses. The chromatogram base-line won't drift.

The Thermal Stabilizer is heated by a long-lived 60-watt Durolite bulb. A graduated dial controls the thermostat setting, and a dial thermometer shows the temperature in the bath. Insulation for the thermal conductivity cell is supplied.

▶ Complete with line cord and grounded plug for use on 115-volt 50/60 cycle a-c, the Thermal Stabilizer is $55.



EPOXY WEARS GOOD*

like a laboratory paint should

TORTURE for over a year and a half—that's the length of time a coat of tile-red Fisher Epoxy Paint has been taking tough chemical-&-mechanical punishment on the floor of the production-control lab in the Fisher Chemical Manufacturing Division. Sweep it, mop it, it looks new.

Meanwhile, out in Fisher's busy Fair Lawn, N. J., plant itself, the epoxy-resin paint—exposed to concentrated acids, strong alkalies and solvents of all kinds—has been doing the same yeoman job. It stands up to the mechanical wear of floor-scuffing work shoes, fork trucks.

Because of this impressive performance, Fisher has arranged to make the new paint available in a special laboratory grade, under its own name, in 4 colors: LABORATORY GRAY (matching the finish on Fisher "Unitized" furniture); GLOSSY BLACK (for bench tops and reagent shelves); TILE-RED (for floors); and a soft shade of YELLOW (for lab and office walls).

Fisher Epoxy Paint adheres tightly *without a primer* to metal, wood, concrete, plastic—even glass. Normal exposure to liquids and steam won't discolor it; heat won't affect it. It's non-absorbent, odorless, flexible, non-toxic.

Fisher Epoxy Paint is supplied in a 2-part gallon can: paint and catalyst are in separate compartments, ready to mix and use. One gallon will cover 450 sq ft; can be applied with brush, roller or spray; hardens in one hour to a glossy finish 75% as hard as glass. You can walk on it in 12 to 24 hours.

▶ Fisher Epoxy Paint is $12 a gallon in gray, black, tile-red; $13 in yellow.

**With apologies to the sloganeers of Winston cigarettes.*

Chromatographers' supermarket:

FISHER STOCKS WIDE RANGE OF COLUMN MATERIALS FOR TODAY'S GAS CHROMATOGRAPHERS

WHAT WITH INNOVATIONS coming fast and furious in gas chromatography, new supports and packings are continually being developed to expedite work in this field—even as new applications are turning up for already familiar supports and packings.

Hence this report—a quick survey of the comprehensive selection of column materials, new AND familiar, at Fisher.

Chromatographic supports

▶ CHROMOSORB W: a chromatographic support developed by Johns-Manville from flux-calcined diatomaceous earth. The flux, you see, alters the structure and surface activity of the material; this partially deactivated surface makes the material ideal for separating polar compounds. Available in 300-gm units as Fisher cat. no. 11-130-52.

Mesh range	Price	Mesh range	Price
30-60	$19.50	80-100	$39.50
42-60	19.50	100-120	33.00
60-80	26.25	100-140	29.50
60-100	19.50	120-140	33.00

Chromosorb W is also available with acid washing, in 30-60 mesh (Fisher cat. no. 11-130-53), at $29.50 per 300-gm unit.

▶ COLUMPAK (also known as Chromosorb P): a chromatographic support developed by J-M from directly calcined diatomaceous earth. Recommended where high column efficiency is needed. Available in 1-lb units as Fisher cat. no. 11-130-50.

Mesh range	Price	Mesh range	Price
10-30	$10.00	80-100	$30.00
30-60	10.00	100-120	45.00
35-80	10.00	120-140	45.00
42-60	21.00	100-140	42.50
60-80	21.00		

▶ GC-22 SUPER SUPPORT: a calcined diatomaceous earth developed by Coast Engineering Laboratories, recommended where high column efficiency is desired. Available in ⅓-lb units as Fisher cat. no. 11-129-500.

Mesh range	Price	Mesh range	Price
12-30	$5.00	60-80	$5.00
30-42	7.00	80-100	7.00
30-60	7.00	100-120	9.00
42-60	7.00		

▶ NEUTRAPORT-S: a silizane-treated, calcined diatomaceous earth from Micro-Tek, designed to reduce tailing effects from polar compounds. Recommended where high column efficiency is needed for the separation of oxygenated materials. Available in 100-gm units as Fisher cat. no. 11-129-505.

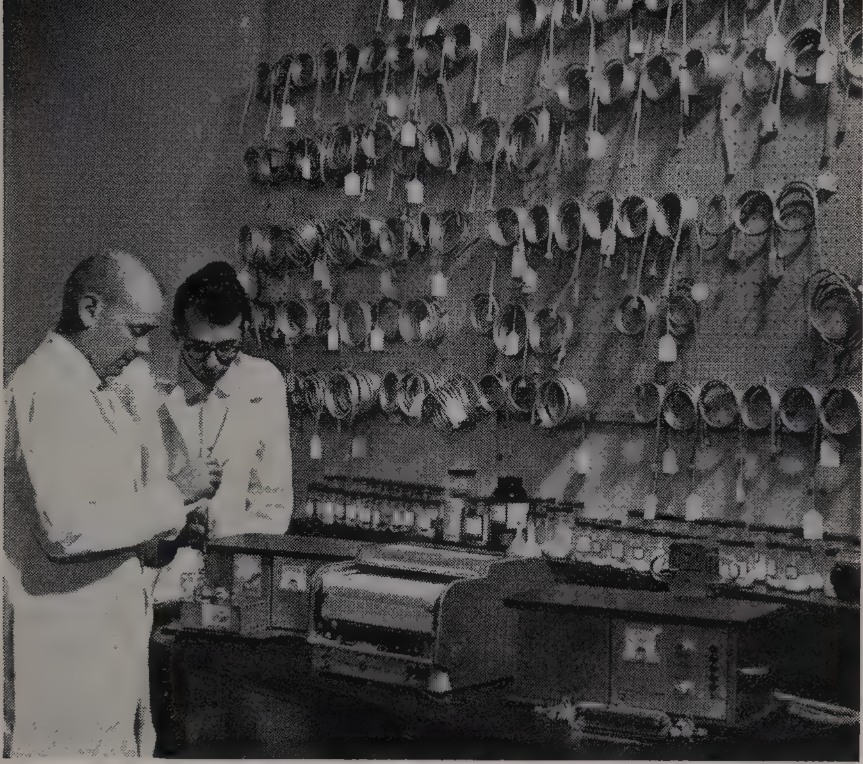
Mesh range	Price	Mesh range	Price
30-60	$12.00	60-80	$12.00
42-60	12.00	80-100	12.00

Solid adsorbents

▶ ACTIVATED MOLECULAR SIEVE 13X: a synthetic silicate adsorbent that causes separation of hydrogen, oxygen, nitrogen, methane and carbon monoxide by a weak reversible adsorption on its surface. Available in 8-oz units as Fisher cat. no. 11-129-515.

Mesh range	Price	Mesh range	Price
12-30	$ 7.50	60-80	$12.50
30-42	12.50	80-100	12.50
30-60	12.50	100-120	12.50
42-60	12.50		

▶ ACTIVATED MOLECULAR SIEVE 5A: similar in performance to Molecular Sieve 13X, except for greater resolution. Available in 8-oz units (11-129-520).



Fisher gas chromatography specialists evaluate packing materials, develop more efficient systems for meeting specific problems.

Mesh range	Price	Mesh range	Price
12-30	$ 7.50	60-80	$12.50
30-42	12.50	80-100	12.50
30-60	12.50	100-120	12.50
42-60	12.50		

▶ ACTIVATED ALUMINA, Alcoa Type F-1: available in 8-oz units as Fisher cat. no. 11-129-525.

Mesh range	Price	Mesh range	Price
12-30	$ 5.00	60-80	$10.00
30-42	10.00	80-100	10.00
30-60	10.00	100-120	10.00

▶ ACTIVATED ALUMINA, Alcoa Type H-151: available in 8-oz units as Fisher cat. no. 11-129-525.

Mesh range	Price	Mesh range	Price
12-30	$ 5.00	60-80	$10.00
30-42	10.00	80-100	10.00
30-60	10.00	100-120	10.00

▶ SILICA GEL: designed for the separation of permanent gases and light hydrocarbons. Available in 8-oz units as Fisher cat. no. 11-129-530.

Mesh range	Price	Mesh range	Price
30-60	$5.00	80-100	$5.00
60-80	5.00	100-120	5.00

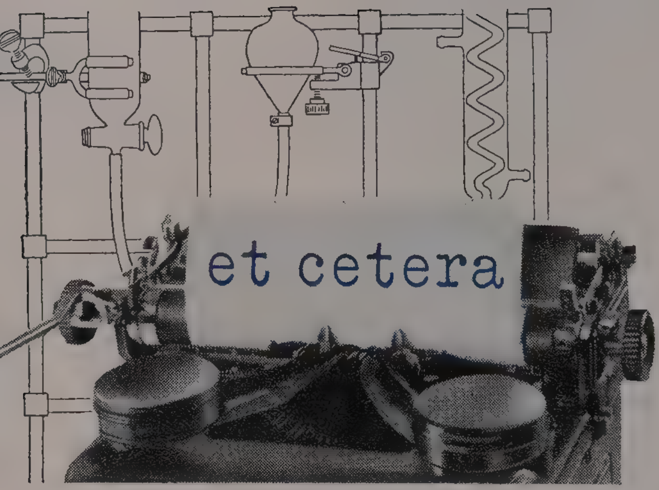
Prepared column packings

Fisher also stocks 3 types of prepared column packing designed for gas-liquid chromatography.

▶ 15% THEED (tetrahydroxyethyl ethylenediamine) on 60-80 mesh Columpak: particularly useful for the separation of alcohols, and alcohols from other oxygenated classes of compounds. (High column efficiency is provided on Columpak—but the water peak "tails.") Available in 50-gm units as Fisher cat. no. 11-130-54. Price: $7.50.

▶ 15% THEED on 60-80 mesh Chromosorb W: with this support material, the tailing of water (mentioned above) is considerably reduced. Available in 30-gm units as Fisher cat. no. 11-130-55A. Price: $7.50.

▶ 30% HMPA (hexamethylphosphoramide) on 60-80 mesh Columpak: a relatively polar liquid phase, useful in the chromatographic separation of light hydrocarbons. (NOTE: recommended maximum operating temperature for an HMPA column is 40°C. Operation *above* 40°C will reduce the effective life of the column through "bleeding" of the liquid phase.) Available in 50-gm units as Fisher cat. no. 11-130-57. Price: $7.50.



MUSIC, MUSIC, MUSIC

MUSIC may have charms to soothe the savage beast, but it gives clinical researchers one big headache.

They've been studying our music men, have come up with a staggering variety of ailments. Here are only a few:

Cocobolo wood in drumsticks has been found by researchers in New York (home of the Metropolitan Opera, the New York Philharmonic, and Tiger Haynes & His Three Flames) to cause dermatitis in certain musicians, hep or otherwise. Cocuswood, used in flute mouthpieces, is another possible allergen, can produce eczematous patches on the lower lip.

Players of wind instruments sometimes wear down their teeth, especially incisors, while excessive pressure on the keys by pianists can produce a loosening of the nails of the left little finger and the right thumb.

Violin varnish (analyzable into anthracene, acridine, and resins) has occasionally given violinists keratosis. These poor devils can also get dermatitis from the rosin-pitch mixture used on the bow; small epidermal hemorrhages on the fingers; and —from the chin-rest of his instrument— one violinist developed a fibro-fatty pad on his jaw!

South African medical researchers have discovered the phenomenon known as "bull-fiddle hand" on players of the big double-bass, whose strings are plucked several thousand times in the course of an evening. A trumpeter's chest pressure will shoot up 300% when he hits the high high notes (no more danger in trumpeting, though, than in coughing).

Even orchestra conductors are not immune to a peculiar occupational hazard: Clinicians record that these gentlemen may get mild spasms of the shoulder and right-arm muscles because of their prolonged pumping at the podium.

MUSIC to medical researchers' ears is the noise produced by the creaky old knee. They have found that applying a sensitive microphone aids diagnosis of rheumatoid arthritis long before it has progressed sufficiently for x-ray detection.

Rheumatoid knee joints of laboratory volunteers have consistently produced a low thud. Knees with the degenerative joint disease called osteoarthritis produce a series of high-frequency bursts at irregular intervals. Normal knee joints, on the other hand, produce sounds uniform in intensity, frequency and wave pattern.

MUSIC can be eyes to the blind. British scientists have developed an electronic reader — the Optophone — that scans a printed page at a given speed with a beam of light, converts letters into musical sounds.

The pitch varies with the shape of the letters. To the Optophone, the Roman alphabet has only 6 basic sounds, but by learning all the chords and permutations, a blind person can "read" 46 words a minute.

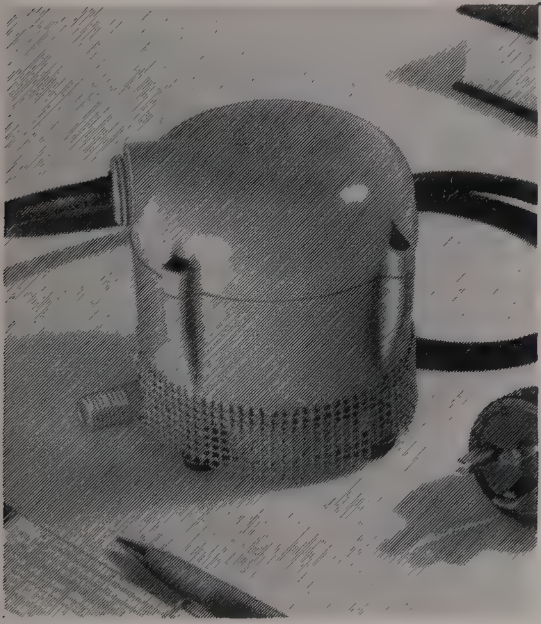
MUSIC's temperamental tyrants — those amply-fleshed concert sopranos— haven't been able to accuse orchestras of being out of tune for some time now, thanks to, of all things, the National Bureau of Standards.

Since 1937, that venerable scientific organization has been shortwaving A above middle C—the note that a musician always sounds before a performance to establish that his instrument is in tune.

By tuning to either of the Bureau's two stations (Beltsville, Md. and Maui, Hawaii) where the note is broadcast some 6 times an hour, 18 minutes per hour, today's instrument manufacturers, piano tuners, chamber ensembles, entire symphony orchestras establish perfect pitch.

This same frequency (440 cycles per second) plus another frequency (600 cycles per second) is also used, in this scientific age, for calibrating laboratory (or *non* do-re-mi) instruments in the audio and ultrasonic regions of the spectrum.

Good thing, small package



APTLY NAMED the "Little Giant" is this new appliance, a circulating pump that doubles as pump and agitator, is completely immersible, and is easy on the budget. It delivers water at the rate of 2.9 gal/min at zero head, 1.7 gal/min at a 5-ft head. What's more, it's able to lift water 10 feet.

Ideal for pumping water, light oils and other non-corrosive liquids, the compact new lab appliance is only 4″ high by 3½″ in diameter.

It makes an ideal stirrer, too, thanks to its 100% waterproof construction. Its sealed motor requires no further lubrication— ever. Motor is fully enclosed in a metal casting; the 8-blade impeller and impeller-cover are nylon. A wire-mesh strainer (*see photo*) prevents dirt from entering the impeller.

▶ Fisher's Little Giant Pump, Model I, uses 0.75 amps, 115-volt 60-cycle a-c. (It should not, of course, be used in hot liquids because of the possibility of overheating the motor.) Price: $18.45.

28:1

28:2

28:3

lab year

A concise index of developments in instrumentation & technique

as recorded in The Laboratory®
vol 28/no 1
through vol 28/no 5

28:4

28:5

▶ INSTRUMENTATION

AINSWORTH RECORDING VACUUM BALANCES — weigh automatically in vacuums, ovens, inert atmospheres (*U.S. ed. only*).
28:1 (28-29)

AINSWORTH RIGHT-A-WEIGH BALANCE — new speedy direct-reading air-damped single-pan balance with ample weighing chamber (*U.S. ed. only*). **28:2 (44-45)**

ARSENIC DETERMINATION APPARATUS — ready-made glassware expedites multiple arsenic determinations using AgDDC-colorimetric method. **28:4 (106)**
Can. ed., **28:4 (108)**

BARNSTEAD BANTAM DEMINERALIZERS — convenient disposable low-cost cartridges give deionized water for small volume needs.
28:2 (52-53)

BAUSCH & LOMB SPECTRONIC 505—an automatic recording spectrophotometer with automatic scanning-speed adjustment priced at level of manual instruments. **28:3 (78-79)**

BECKMAN DB SPECTROPHOTOMETER — new double-beam, quartz-prism spectrophotometer with 100% compensation and direct-reading meter, moderately priced. **28:3 (92-93)**

BECKMAN MODEL 1401 DB — new version of Beckman's DB Spectrophotometer has extended range for both ultraviolet and visible spectra, offers both programmed and manual slit control. **28:4 (119)**
Can. ed., **28:4 (125)**

BECKMAN GAS CHROMATOGRAPHS — GC-2 analyzes gases and liquids boiling up to 350°C, while low-cost GC-1 analyzes samples boiling up to 80°C. **28:4 (124-125)**
Can. ed., **28:4 (126-127)**

BECKMAN HYDROGEN FLAME DETECTOR—an ultra-sensitive carbon-atom counter that measures trace components, extends the range of Beckman's GC-2 Gas Chromatograph.
28:4 (124)
Can. ed., **28.4 (126)**

BECKMAN LAB RECORDER — adjustable-span recorder designed for use with Beckman's DB and other spectrophotometric instruments.
28:3 (92-93)

BECKMAN pH METERS—two new models: 76 for high-sensitivity pH changes of 0.005 units or less; lower-priced 72 for small industrial labs, schools. **28:3 (84-85)**

BENDIX DOSIMETER—Model 862 is a clip-on monitor for gamma or x-ray sources in the laboratory. **28:5 (147)**

BETHLEHEM GLASSBLOWING KIT — 40-piece

NOTE: *where U.S. and Canadian editions have differing pages, this is indicated; also where an item appears in either the U. S. or Canadian edition exclusively.*

"do-it-yourself" kit for lab. **28:4 (118)**
Can. ed., **28:4 (121)**

BETHLEHEM SHARP-FLAME — hand-torch for working hard glass and quartz, silver soldering, features "surface" mixing that eliminates flashback and noise. **28:3 (90)**

BURETS — Pyrex® "Accu-red" (with graduations fired into the glass) now have "Reverse-Taper" stopcocks made of Teflon.® **28:3 (91)**

CAHN RM ELECTROBALANCE — fully automatic microgram weighings with an accuracy of ±0.05%. **28:3 (86)**

CAHN STIRRUP — perforated or solid stirrups designed for the new Cahn Electrobalance (above); hold sample boats used with the popular Coleman Nitrogen Analyzer. **28:4 (119)**
Can. ed., **28:4 (125)**

CALIBRATION REFERENCE BATTERY — low-impedance, multi-voltage mercury reference battery assures reliability of measurements made with electronic instruments. **28:5 (155)**

CASTALOY®-R—famed pioneering line of corrosion-resistant laboratory clamps, supports and holders now completely re-designed for greater versatility; new micro sizes. **28:4 (108-109)**
Can. ed., **28:4 (110-111)**

CHROMATOCAB — benchtop unit for paper chromatography combines compactness of glass jar unit with insulation and vapor seal advantages of cabinet unit. **28:1 (11)**

COLEMAN AUTOFLOW SYSTEM—sample-handling system speeds flame analysis 300%. **28:5 (146)**

COLEMAN COMPANION pH METER—accuracy of ±0.05 pH unit, measurements reproducible to ±0.02 unit over the full 0-14 pH range. **28:5 (159)**
Can. ed., **28:5 (148)**

COLEMAN METRION pH METER — accuracy of ±.05 pH unit (reads to ±.02 unit), plus an unlimited electrode selection in this moderately-priced unit. **28:3 (77)**

COLEMAN MICRO ACCESSORIES — "Perfect Rounds" cuvet, cuvet adapter and "Micro-Space" cuvet insert make possible spectrophotometric measurements through a full 1.0-cm solution path, using only 0.7 ml of sample solution. **28:2 (50)**

COLEMAN NITROGEN ANALYZER—performs Micro-Dumas nitrogen analyses automatically, is ideal for food, textile, pharmaceutical, tobacco and chemical processing industries. **28:3 (82-83)**

FISHER DUO-SPECTRANAL® — unique spectroscope for fast qualitative analysis of many common metals—also semi-quantitative. **28:1 (8-10)**

FISHER GAS-SAMPLING VALVE—assures reproducible sample volumes in gas chromatography. **28:2 (42)**

FISHER LAB-LIFT—raises, supports and positions hot, heavy, radioactive or awkward lab equipment. **28:1 (15)**

FISHER LABORATORY RECORDER—a 1-mv potentiometric unit that records any instrument readings that are convertible into d-c millivolts in the Recorder's range. Fast response. **28:3 (88)**

FISHER-MACHLETT AUTOMATIC PIPET — of Pyrex® glass, with Teflon® stopcock; pipet is easy-to-use, errorless. **28:1 (24)**

FISHER REAGENT-BOTTLE POUR/SPOUT—inert, unbreakable polyethylene spouts that make pouring safer, keep bottles and bench-tops clean; 9 sizes. **28:1 (31)**

FISHER ROUND CUVETS — high silica glass transmits down to 190 mμ; these cost far less than traditional square silica cuvets. **28:5 (158)**

FISHER "S"-RACKS — one-piece anodized-aluminum test-tube racks of unique design are unbreakable, resist common corrosives, stack easily. **28:2 (45)**

FISHER SELECTA-JET™ BLAST BURNER—gives five distinct flames at the twist of a wrist with no waiting, no re-ignition. **28:4 (105)**

FISHER STANDARD GLASSWARE WASHER — new medium-capacity automatic washer solves the dirty-glassware problems for average-sized and small labs. **28:4 (110-111)**
Can. ed., **28:4 (116-117)**

FISHER TENSIOMAT™ — provides semi-automatic measurement of surface and interfacial tension, eliminates errors of manual methods. **28:3 (72-73)**

FISHER TITRIMETER®—Model 35 for manual and Model 36 for automatic potentiometric performance of acid/base, oxidation/reduction, precipitation, complexation, dead-stop titrations. **28:5 (136-138)**

FISHER VIBROMATIC™ POLISHER—automatic polisher prepares up to 20 metallographic samples at once, can be used by even inexperienced personnel. **28:4 (114-115)**
Can. ed., **28:4 (106-107)**

FISHER VINYL/TUBE — clear vinyl tubing for wide range of chemicals (at about half the price of conventional flexible plastic tubing). **28:2 (62)**

GLAS-COL HEATING TAPE—"double-element" design ends problems of electrical connection at both ends, makes tape complete with a single insulated plug at one end only. **28:4 (121)**

HEATED VACUUM DESSICATOR — combines functions of drying oven, vacuum oven, anaerobic oven, incubator and dessicator in one 9-lb Precision package. **28:5 (149)**

HYSIL® and QUICKFIT®—two lines of borosilicate laboratory glassware exceptionally resistant to chemicals and thermal shock. *Can. ed.*, **28:1 (23)**

INTERNATIONAL CENTRIFUGE — Model CS Centrifuge provides higher speeds, greater centrifugal forces. **28:4 (117)**
Can. ed., **28:4 (115)**

KIDDE FIRE EXTINGUISHER—dry-chemical unit goes to work at the touch of a finger; equivalent wallop of 8 one-quart carbon tet extinguishers. **28:1 (31)**
Can. ed., **28:2 (45)**

KIMAX® - TEFLON® COMBINATION — Kimax hard glass labware with Teflon stopcock plugs that resist even the most corrosive chemicals. **28:1 (18)**

KIMBLE SQUARE-SHAPED FLASKS — made of durable Kimax® borosilicate glass, these volumetric flasks pack more closely, add more capacity to shelves, refrigerators. **28:2 (57)**

LINDBERG ELECTRIC BOX FURNACE — low price, economical operation make this compact furnace ideal for fusions, ignitions, assaying in labs with moderate work-loads. **28:2 (43)**

LKB CHROMATOGRAPHIC SYSTEM — a complete integrated system for the chromatographic isolation and purification of closely related substances. *Can. ed.*, **28:1 (28-29)**

MANOSTAT MICROTITRATOR — titrates quantities as small as a single drop electrometrically, without end-point adjustments. **28:1 (14-15)**

MECHROLAB OSMOMETER—offers a quick, accurate way for polymer chemists, petroleum chemists, biologists, pharmacologists to determine molecular weights. **28:5 (142-143)**

METROHM POLARECORD—flexible high-speed polarographic assembly also "doubles" for amperometric and potentiometric titrations, is an accurate millivoltmeter. *Can. ed.*, **28:4 (118-119)**

METTLER KILOGRAM-CAPACITY ANALYTICAL BALANCE — speedy single-pan instrument weighs up to 1000 grams with an accuracy of ±0.1 mg. **28:1 (21-22)**

METTLER MULTI-PURPOSE BALANCE — speedy single-pan instrument weighs up to 10 grams (to the nearest milligram) entirely on the optical scale. **28:1 (22)**

METTLER SINGLE-PAN RECORDING BALANCES —achieve the recording sensitivity of a *meter-wide* chart from paper that is only 1/5 that wide. **28:1 (20-21)**

NALGE UTILI-PUMP—inert, non-contaminating polyethylene hand pump for transferring chemicals from carboys to reagent bottles. **28:3 (95)**

OHAUS CENT-O-GRAM BALANCE — a lightweight, 311-gram capacity instrument, complete with carry-case for easy portability. **28:2 (56)**

PLATINIZING KIT, MODEL PK-1 — compact unit cleans, re-coats worn electrodes, ends erratic undependable readings. **28:4 (123)**

POLY-PAC—unique 5-gallon polyethylene bottles from Fisher dispense reagents as needed while still in their disposable cardboard carton, do away with heavy glass carboys. **28:1 (12)**

POUR-EASY CHEMI-RACK — tilts 5-gallon drum, dispenses liquid without need to lift. **28:2 (51)**

PRECISION VACUUM PUMP — Model 25 is lightweight, compact, designed for labs with relatively small systems to evacuate. **28:4 (120)**
Can. ed., **28:4 (124)**

PYREX® DOUBLE-TOUGH DRAINLINE — glass piping guaranteed against corrosion and leakage for the life of any building. **28:1 (27)**

PYREX® O-RING JOINTS — spherical-shaped joints are precision-tooled to take a vacuum-tight O-ring seal, are the quickest way to set up and take down complex glass systems. **28:5 (148)**
Can. ed., **28:4 (122)**

REEVE-ANGEL ION-EXCHANGE PAPERS — resin-loaded papers combine the *chemical* action of Amberlite® resins with the *physical* separation of paper; also described are Whatman filter papers whose own cellulose has been converted into a series of ion-exchange compounds. **28:4 (116)**
Can. ed., **28:4 (114)**

REVERSE-TAPER STOPCOCKS — Pyrex® Teflon®-plug stopcocks taper *towards* the handle, are under constant spring tension for leakproof seal, can't be accidentally dislodged. **28:2 (47)**

SCHÖNIGER IGNITION ASSEMBLY — quick, safe Schöniger ignitions are made electrically behind a tough plastic shield that holds back any possible explosions. **28:5 (152)**

SQUIBB SEPARATORY FUNNELS—these well-made Pyrex® funnels now have Reverse-Taper Teflon® stopcocks as standard equipment. **28:3 (91)**

TAYLOR RECORDING THERMOMETER — new Weather-Hawk Remote-Reading Recording Thermometer priced for low budgets. **28:2 (55)**

TELETHERMOMETER—YSI Model 42 measures temperature over range of 190°C (or 340°F) with accuracy of ±0.5°C (or ±1°F). **28:5 (156-157)**

THERMOLYNE ELECTRIC FURNACE—utility-size furnace offers speedy heating, precision control, man-hour savings. **28:1 (19)**

THERMOLYNE HOT-PLATE—Model 2300 is small (3½" high), rugged, provides a precision heat source where laboratory space is scarce. **28:3 (87)**

THERMOLYNE STEPLESS INPUT-CONTROLLER—compact timer thermostatically controls power input to flask heaters, heating tapes, water baths. **28:3 (87)**

TORSION BALANCE—Model DLT-5 is 500-gram capacity instrument with "dial-the-weight" feature that cuts weighing time 60% and more. **28:1 (24)**

TORSION DIAL BALANCES—4 new models have increased range (up to 500 grams) and built-in speed (thanks to *two* weighing dials). **28:5 (150-151)**

VACU-TROL™ ISOLATOR LAB—bench-top unit for research work under controlled atmosphere completely isolates its contents from outside atmosphere. **28:5(139)**

WATER-BATH SHAKER—cast-aluminum unit for biological and biochemical studies that require constant temperature plus agitation. **28:1 (26-27)**

WEISZ RING OVEN—unique analytical apparatus for separating, identifying cations, unprecipitated ions. **28:1 (25)**

WET-TEST METERS—cast aluminum for longer life, greater resistance to even the corrosive, acid-laden gases metered in many industrial situations; Precision-made. **28:5 (153)**

YSI RECORDER—Model 80 is an 11-lb portable recorder, covers wide range from 10 millivolts to 500 volts, will record almost any d-c instrument. **28:5 (156-157)**

ZIRCONIUM WARE—Fisher crucibles of pure zirconium 1/6 price of platinum. **28:5 (151)**

▶ THE SCIENCES

"A" AS IN ANESTHETICS—how chemists and clinical researchers (from Simpson, Davy, Priestley and Liebig to modern pharmaceutical giants) have banished pain. **28:2 (34-39)**

BRAINS—human version thinks in 40 dimensions, electronic computers in 18, say psychologists. **28:1 (30)**

CAMELS—research reveals they have no special organ for storing or producing water, rely on the frugal economy of their physiology. **28:2 (46)**

CATTAILS—Syracuse University researchers find them a versatile material for insulation board, life preservers, livestock feed, wax, ethyl alcohol. **28:1 (30)**

CHEMISTS & THE NOODLE-TOPPED STROODLE—thanks to modern research, Toyland is fast becoming a world of color-fast unbreakable new plastics, germ-free paint, psychologically-designed kits to stimulate young scientists. **28:5 (130-135)**

DRY RUN FOR LIQUIDS—how chemistry professor Dr. John W. Baxter uses TV's coast-to-coast "Continental Classroom" in a major project in science education. (*U.S. ed. only*) **28:1 (23)**

FIRE—U. S. Forest Service researchers set fires under controlled conditions to learn how to control "real" ones effectively. **28:3 (80-81)**

HOBBES—17th Century English philosopher discovers joys of geometry at age of 40. **28:5 (145)**

MARK TWAIN—in a letter to Walt Whitman on Whitman's 70th birthday, Twain lists the scientific achievements of a life-time. **28:3 (80)**

MICROBES—they're clogging fuel-line filters in jet planes; additives may curb 'em. **28:5 (144)**

MOBILE LABS—U. S. Army has one in a converted C-54 plane, while South Vietnamese medical units use elephants. **28:1 (30)**

PASTEUR—he's honored in Russian journal in rare plea for international cooperation. **28:5 (145)**

PHILIP J. ELVING—professor of chemistry, University of Michigan, and prolific researcher (with well over 140 published works) receives 1960 Fisher Award of the American Chemical Society (*U. S. ed. only*). **28:4 (126)**

SCIENCE ON THE RIGHT TRACK—how research has transformed the world of railroading through electronics, chemistry, automation. **28:1 (2-7)**

SNAKES—chemists at Midwest Research Institute are protecting them from mites. **28:2 (46)**

SO SWEET A SCIENCE—sugar is today the subject of a multi-nation multi-million-dollar research program. **28:3 (66-71)**

THE 25,000-MILE HAND—from the days of 17th Century nuns, the healing hand of Canadian medical research now stretches around the world through achievements in insulin, heart surgery, cancer research. **28:4 (98-104)**

THE $100,000,000 BITE—Koppers entomologist conducts basic research into the gastric habits of the hungry termite while searching for the ideal wood preservation treatment. (*U. S. ed. only*) **28:4 (112-113)**

VERNE—his writings predicted auto, helicopter, sub, movies, seaplane, phonograph, lunar probes. **28:3 (81)**

WHAT FISHER'S NEW SOUTHWESTERN DIVISION MEANS TO YOUR LABORATORY—how Fisher's new branches in Houston, Fort Worth and Odessa (Texas) add to the *national reservoir* of Fisher scientific equipment available through any one plant anywhere (*U. S. ed. only*). **28:4 (127)**

WHEN 15,000 MEN CELEBRATE A BIRTHDAY—a salute to the U. S. oil industry's 100th birthday, and to the 15,000 scientists and technicians in its laboratories (*U. S. ed only*). **28:1 (16-17)**

▶ REAGENTS

ACETONE—high-purity reagent now lot-analyzed for boron as well as aluminum, antimony, arsenic, copper, gold, iron, lead, nickel, silver. **28:2 (40)**

CADMIUM FLUOBORATE 50% — low-metal content makes this ideal plating solution in production of electronic components. **28:5 (140)**

"CERTIFIED" INFRARED REAGENTS — Pyridine/Infrared and Carbon Disulfide/Infrared, Fisher ultra-pure "Spectranalyzed" reagents that eliminate blanks, save time in the spectroanalysis of organics. **28:1 (13)**

"CERTIFIED" SOLVENTS—newly available in the top-purity Certified grade: Ethylene Dichloride for organic syntheses; Ethylene Glycol Monomethyl Ether for colorimetric determinations of cations, anions; Triethanolamine as a chromatographic solvent. **28:5 (140-141)**

CHROMATOGRAPHIC COLUMN PACKINGS—three *ready-made* packings: 30% HMPA (Hexamethylphosphoramide); 15% THEED (Tetrahydroxyethyl-Ethylenediamine) on 60-80 mesh Columpak; and 15% THEED on 60-80 mesh Chromosorb-W. **28:3 (76)**

CHROMERGE — powerful concentrate of chromic acid in sulfuric acid quickly dilutes to a fresh supply of chromic acid for cleaning complex glassware. **28:4 (107)**
Can. ed., **28:4 (109)**

CHROMOUS CHLORIDE—a lot-analyzed high-purity "oxygen-grabber" for gas analysis. **28:1 (12)**

COMBAX® ACCELERATOR — handy new chip form of pure iron, ideal for steel labs running carbon, sulfur tests. **28:2 (41)**

DISTILLED WATER—CO_2-free and tested for high resistivity, ideal as a wash in the electronics industry. **28:3 (75)**

DITHIOLS—a fast, *stable* detector for metallic ions is now possible by generating Dithiol from three stable crystalline derivatives: Fisher ZDT (Zinc Dithiol), DADT (Diacetyl Dithiol), DBDT (Dibenzoyl Dithiol). **28:3 (74-75)**

DORCOL® — or hexamethylphosphoramide, powerful non-reactive solvent for acetylene. **28:1 (12-13)**

"ELECTRONIC-GRADE" SOLVENTS — Fisher Acetone, Trichloroethylene, Methyl Alcohol, each lot-analyzed for ultra-purity. Use: cleansing baths for delicate parts in electronics. **28:2 (40)**

GLACIAL ACETIC ACID—new lower price thanks to lightweight packaging by manufacturer Fisher in no-deposit, no-return polyethylene-lined drums. **28:3 (75)**

HYDROGEN PEROXIDE 30%—extremely low chloride concentration lessens chance of metal corrosion. **28:3 (75)**

LANTHANUM CHLORANILATE—for quick, accurate colorimetric determination of phosphate, fluoride. **28:4 (106-107)**
Can. ed., **28:4 (108-109)**

METHYL ALCOHOL—metal contaminants and

DISRAELI ON PUBLIC HEALTH—*"Public health is the foundation upon which rest the happiness of the people and the power of the state. Take the most beautiful kingdom, give it intelligent and laborious citizens, prosperous manufacturers, productive agriculture; let arts flourish, let architects cover the land with temples and buildings; to defend all these riches, have first-rate weapons, fleets of torpedo-boats . . . If population remains stationary, if it decreases yearly in vigour and in stature, the nation must perish. That is why I consider that the first duty of a statesman is the care of public health."*

boron kept to 0.00001%; water content lowest of any commercial methanol available. **28:2 (40)**

POTASSIUM NITRATE—a Primary Standard reagent of highest-precision assay, designed for analysis of fertilizers via A.O.A.C. referee method. **28:1 (13)**

POLY-PAC REAGENTS—15 Fisher solutions now available in unique high-safety, self-dispensing Poly-Pac. **28:5 (141)**

SEWAGE-TESTING SOLUTIONS—11 ready-to-use reagent-grade solutions for standard APHA tests in sewage-treatment plants. **28:3 (76)**

SILICIC ACID—in the particle size specified by the Hirsch-Ahrens modification of the Ramsey-Patterson method for chromatograph separation of bio-organics. **28:1 (13)**

SILVER DIETHYLDITHIOCARBAMATE—for colorimetric determination of arsenic in petroleum refining, food and drug production, industrial hygiene studies. **28:3 (75)**

SPECTRANALYZED™ REAGENTS—all purified by Fisher till the absorbance in a specific region of the ultraviolet or infrared is brought to a minimum. **28:2 (40-41)**

STANDARD SOLUTIONS—Fisher's widely-used Karl Fischer Reagent, Sodium Hydroxide Solution 50%, and Potassium Hydroxide Solution 45%, all at new lower prices. **28:2 (41)**

THENOYLTRIFLUOROACETONE — TTA for short, this lot-analyzed reagent finds wide use as an extraction solvent for metals, especially uranium, rare earths. **28:1 (13)**

THORIUM CHLORANILATE—for fast, easy colorimetric determination of fluoride in calcium oxide (ignores cations, eliminates distillation). **28.4 (107)**
Can. ed., **28.4 (109)**

TRICHLOROETHYLENE—all metal contaminants (plus boron) are kept to a maximum of 0.00001%. **28:2 (40)**

TWO NEW ALUMINAS—Neutral and Acidic, aid the chromatographer to detect, isolate and purify isotopes, vitamins, drugs, enzymes, proteins, fats. **28:2 (41)**

VANADIUM PENTOXIDE—oxidant catalyst (in hydrocarbon cracking and oxidation of organics) now available in Certified grade. **28:5 (141)**

▶ TECHNIQUES

ARGON SEPARATION—an analytical "breakthrough" has been made in separating argon from oxygen and nitrogen by gas chromatogtaphy. **28:5 (154-155)**

DIRECT-READING BALANCES — single-pan Gram-atic® models expedite Karl Fischer moisture determinations by quick dry weight-percent calculations. **28:3 (95)**

FILMS—transparent films can be chemically classified easily "with scissors, a match, a sense of smell." **28:2 (54)**

GEL STRENGTH—in all types of colloidal materials is measured more accurately with an ingenious transistorized gelometer. **28:4 (122)**

IODINE DETERMINATION—it's fast, easy, requires only a small sample, in polarographic analysis. **28:3 (94)**

LIFE TESTS OF CAPACITORS—they're made more cheaply by using a standard B. O. D. Incubator. **28:3 (95)**

METAL POWDERS—Linde produces 98% perfect metal spheres 20 microns in diameter. **28:5 (154)**

NAPHTHA STREAM ANALYSIS—by modifying a Fisher-Gulf Partitioner, quality-control chemists analyze for methylcyclopentane, cyclohexane, benzene. **28:3 (94)**

POWDERED UO_2—can be measured for average particle size with a Fisher Sub-Sieve Sizer by substituting helium or argon for air, and low vapor-pressure oil for water. **28:3 (94)**

SCALED ATOM MODELS—aid study of the relationship between molecular size and weed-killing power of organic molecules. **28:5 (154)**

SIZE-ANALYSIS OF LIQUID AEROSOLS—6 improved methods for aerosol work in smog, aviation medicine research. **28:2 (54)**

WATER DETERMINATION—small, costly samples done by microtitration with Karl Fischer Reagent, using dry gas in the titration cell, amperometric measurement and a Fisher Electropode® for the entire external circuit. **28:2 (54)**

▶ ART

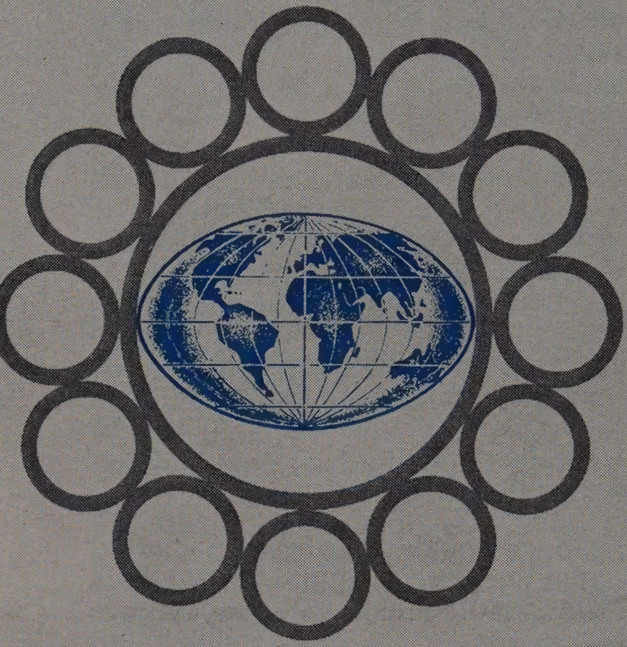
JAMES SIMPSON—ink portrait by 19th Century German artist Frederick Pape of pioneer clinical user of chloroform; original in Fisher Collection. **28:2 (front cover)**

L'OPTIQUE—graceful 18th Century French engraving by Charles Cochin suggests "solar" heating, symbolizes the basic sciences of optics and light; original in Fisher Collection. **28:1 (front cover)**

MATURE AGE, EAGER YOUTH—handsome 18th Century Venetian engraving by Francesco del Pedro from the painting by Maggiotto depicts aged scientist, young assistant; original in Fisher Collection. **28:5 (front cover)**

SIR FREDERICK BANTING—portrait by artist-physician F. H. Netter (see 28:5 [144]) of the co-discoverer of insulin; original in University of Toronto. **28:4 (front cover)**

Global symbol



This symbol, originated by the alchemists of old, was universal. In every country, in every language, it meant "the laboratory."

Today—with an "F" in its center—it is Fisher Scientific's registered trademark for laboratory instruments, apparatus and reagent chemicals. It, too, has a universal meaning: "service to science."

FISHER SCIENTIFIC

the complete source for laboratory needs

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CHEMICAL MANUFACTURING
CUSTOM GLASSBLOWING
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4102 Greenbrier Dr

NEW YORK 14, NY
633 Greenwich St

ODESSA, TEX
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